American Machinist

Volume 54 NEW YORK, APRIL 7, 1921 Number 14

Rockford No. 3 "High-Power" Milling Machine

Evolved From Earlier Models—Rectangular Overarm Moved by Rack and Pinion—Universal Joints Eliminated—Single Control for Feed and Quick Return

By J. V. HUNTER
Western Editor, *American Machinist*

MILLING machines formerly built by the Rockford Milling Machine Co., Rockford, Ill., have undergone extensive changes in design, the result being the No. 3 "high-power" all-geared, single pulley drive machine shown in Fig. 1. A number of the special features in the earlier models have been retained and many others have been added, noticeable among which is the method of transmitting the feed drive to the saddle and table mechanism, as shown in Fig. 2, eliminating the use of a telescopic feed shaft and universal joints. Refinements have been made in the overarm, thus adding to the advantages claimed for the rectangular type. The feed and speed gear change mechanism has been entirely redesigned and employs sliding gears for changing the feeds instead of the tumbling gear previously used. A control box on the right side of the machine permits the feed and quick return in either direction to be started or reversed at the will of the operator by the movement of a single lever. Other details will be mentioned in connection with the general description of the machine.

The column is of the conventional box form and is used to inclose a large portion of the working mechanism. The column is stiffened by internal ribs and is divided internally into three compartments, the upper one comprising an oil chamber in which is mounted the spindle gear units. The middle compartment contains the mechanism of the feed gears, which run in an oil bath. The lower compartment serves as a reservoir for the supply of coolant. The levers for operating the speed and feed gear change mechanism are located on the left-hand side of the column, as shown in Fig. 1. The overarm is rectangular in form with a cross-section of 4½ x 9 in. It is of cast iron, planed and scraped and fits in a similarly finished groove or slot across the top of the column. It is held down by a broad flat cap rabbetted so that dependence is not placed in the bolts alone for holding it in position.

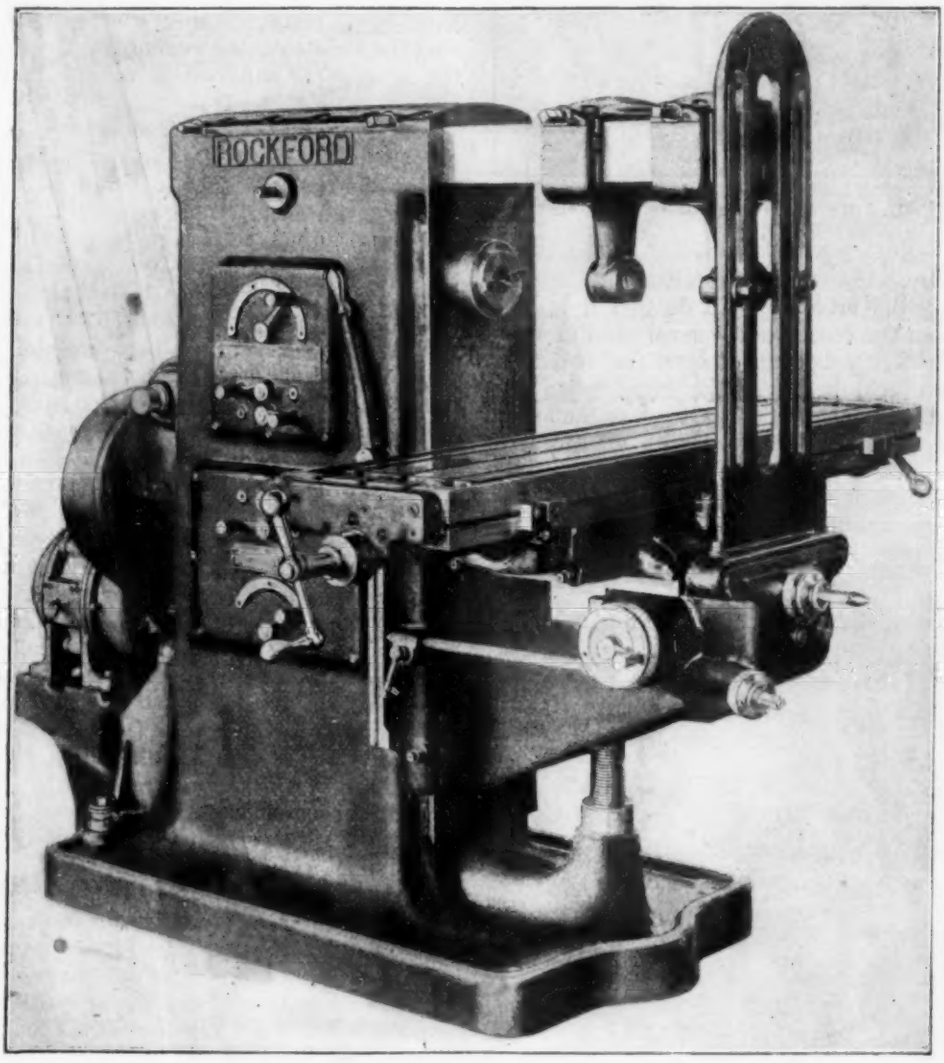

FIG. 1. ROCKFORD NO. 3 ALL-GEARED MILLING MACHINE

The overarm is moved by means of a rack and pinion and is clamped in position by two eccentrics operated through quills extending from the cap on the left side of the machine.

The overarm can be moved as shown in Fig. 3 for

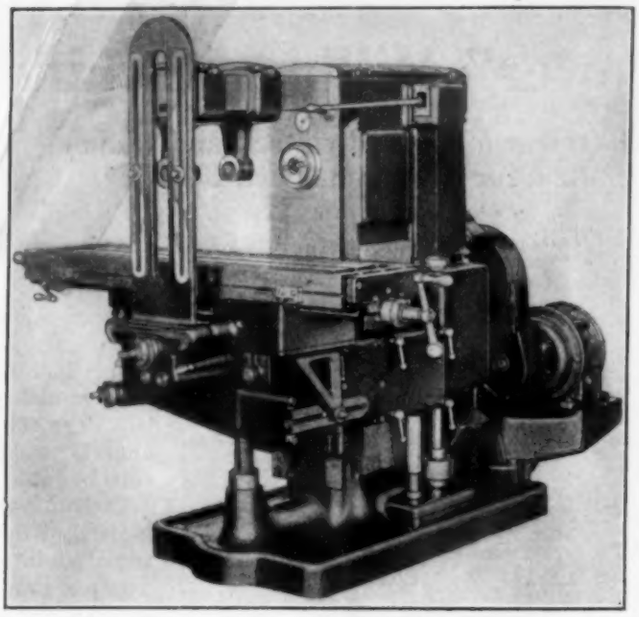

FIG. 2. RIGHT SIDE OF MACHINE SHOWING FEED CONTROL BOX

removing work from the table or for changing cutters without removing the brackets. To do this it is only necessary to loosen the eccentrics, remove the nut from the end of the cutter arbor and loosen the two bolts that hold the overarm brace to the knee, when the overarm can be moved out until all parts clear the arbor. This arbor support is also provided with an eccentric clamping device. The distance from the center of the spindle to the under side of the overarm is 7¼ inches.

Since the overarm must be in alignment with the

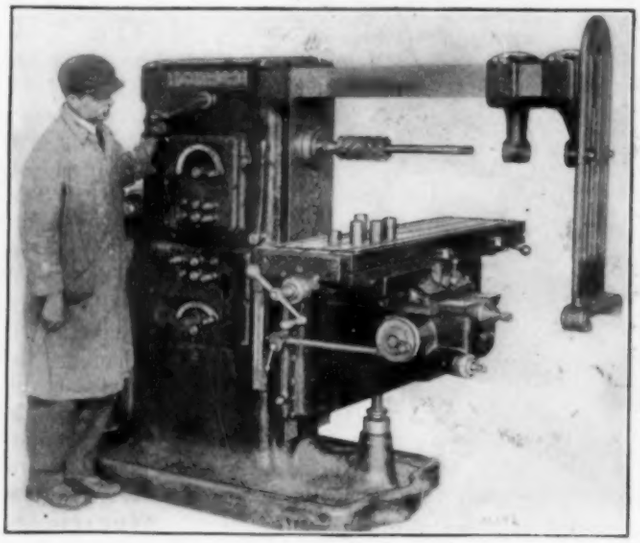

FIG. 3. OVERARM EXTENDED TO PERMIT REMOVAL OF CUTTERS

spindle it may be used in a number of ways for setting up and aligning work. In Fig. 4 is shown how it may be used with a test indicator mounted on a gage block abutting against the side of the overarm to determine whether the face of the work is parallel with the spindle.

The spindle has been designed so that all wear may be taken up by a single nut located at the rear end. The arbor is driven by two hardened steel keys which fit in keyways in the nose of the spindle. A reverse for the spindle drive is provided by a shifting mechanism located in a gear box on the rear of the machine.

The speed gears slide into mesh and are controlled by three levers mounted on the coverplate of the gear compartment. The position of the levers for the different speeds is clearly indicated by an index plate.

The knee has been designed with the idea of giving it ample bearing surface on the face of the column. Additional bearing surface is provided by a wide face *A*, Fig. 5, on the side of the column, and to this the extension arm or brace *B* from the side of the knee may be clamped when it is desired to secure the knee with greater rigidity. The extension arm is locked in place by means of four bolts *C* that clamp beneath flanges on the sides of the surface *A*.

The saddle is held to its bearing on the top of the knee by adjustable taper gibs. When taking heavy cuts the saddle can be clamped to the knee by means of the bracket *D* and bolt *E* so as to obtain additional rigidity.

The table has three T-slots and is provided with grooves along its sides and pockets at the ends to collect the coolant. The longitudinal feed is controlled by a lever on the front of the saddle. The vertical, cross and longitudinal feed screws are all fitted with end thrust bearings; and the two latter have take-up nuts for adjusting wear. The feed screws have adjustable micrometer dials graduated to 0.001 inch.

The feed gears are a separate unit housed in the middle compartment of the column. Three levers are used to shift the feed gears which give a total of twelve feeds ranging from ½ to 16 in. per minute. On the left-hand side of the knee, Fig. 1, is a feed control box that determines whether the transverse or vertical feed is being engaged. It has a circular top with a rotating lever pivoted in its center, and when this lever is in the right-hand notch, by depressing the lever *G*, Fig. 5, the transverse feed is engaged. The vertical feed is engaged by rotating the control levers to the left and again depressing the lever *G*. The vertical and transverse feeds can also be controlled by a lever on the left side of the knee near the column and in convenient reach of the operator, who may stand back of the table for such operations as boring. The bar that connects this lever with the feed control box passes through the back flange of the knee and projects to a point where it reaches the dogs of the automatic stop mechanism. There is a long vertical boss on the side of column on which dogs may be adjusted to contact with the feed bar and stop the vertical feed at any predetermined point. The boss also has permanent safety stops to stop the feed within safety limits.

Another feature is the power quick return and feed control box. This is the box with a long lever extending toward the front of the machine, located on the upper right-hand side of the column, Fig. 2. The lever may be shifted to any one of four stations and the stations are in pairs, one pair controlling the feed in either direction and the other pair the power rapid traverse in either direction. To feed the table toward the left the lever is moved from the central position toward the column and into the lower left-hand notch. To reverse

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the feed the shifter lever is raised to the notch directly above. Correspondingly the notches on the right indicate the direction of travel of the power rapid traverse. The feed control box operates either the longitudinal,

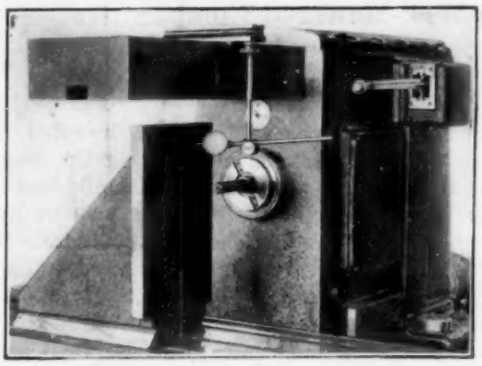

FIG. 4. USING OVERARM TO ALIGN WORK PARALLEL TO SPINDLE

transverse or vertical feed and quick return, whichever machine movement is engaged with the feed gears at the time.

Feed Drive to the Table

The feed reverse and quick return gears are located in the larger of the boxes on the right-hand side and near the rear of the column. This gear box is connected by suitable mechanism with the feed control box described in the preceding paragraph. From this gear box the drive shaft *F*, Fig. 5, extends to a second gear box *I*, located on the base of the machine. At *J* is a shock absorber that can release the feed drive in case of any accident or carelessness on the part of the operator. From the gear box the feed is engaged through the vertical splined shaft *K* that connects through a pair of bevel gears with the drive shafts in the knee. This method of conveying the feed eliminates the use of universal joints.

The vertical milling attachment clamps onto the overarm and to the face of the column. A plug on the face of the column directly under the overarm is removed and the drive shaft of the attachment is inserted. The shaft is driven directly from a gear mounted between

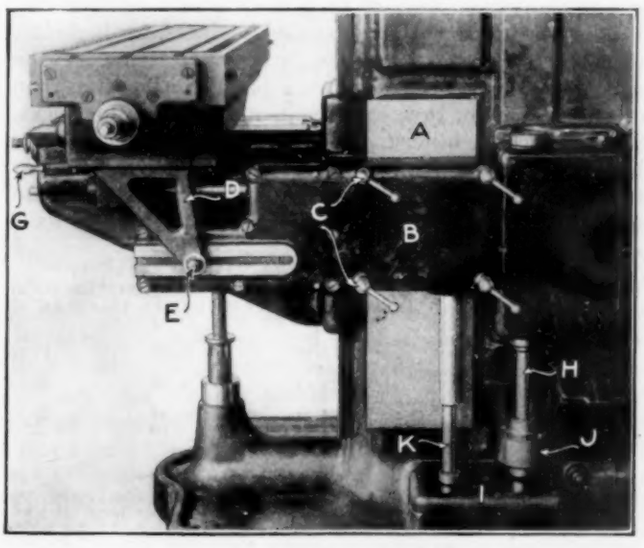

FIG. 5. KNEE AND SADDLE BRACING AND FEED DRIVE SHAFTING

bearings at the forward end of the spindle close to the front wall of the column. This arrangement permits the use of the vertical attachment without removing the overarm.

All gears are hardened and ground and the shafts are similarly treated. The gears all run in a bath of oil which is supplied through six oiling stations.

Method of Drive

The machine can be furnished with either belt or motor drive. When belt driven the drive is through a single constant speed pulley mounted on roller bearings. A Johnson friction clutch has been incorporated in the pulley with adjustment at the back of the machine where it is easily accessible.

When motor driven the motor is mounted on a heavy pedestal bolted to the rear of the column and base. A 10-hp. motor is recommended. The motor drives through a high-speed silent-link chain covered by safety guards.

The coolant pump is mounted on the rear of the feed change gear box, and draws the coolant from the reservoir in the base of the column. The coolant is delivered to the cutters through a flexible pipe extending along the side of the overarm.

The length of floor space required by the machine is 126 in. parallel with the spindle, allowing for the extension of the overarm to the limit at both extremities.

Specifications: Table: working surface, 15 x 55 in.; travel, longitudinal, 34 in.; transverse, 12 in.; vertical, 20 in. Twelve feeds ranging from ⅛ to 16 in. per minute. Sixteen speeds ranging from 15 to 422 r.p.m. Feed and quick return controlled by single lever. Spindle bored for No. 11 B & S taper, with 1-in. hole clear through. Overarm section, 4½ x 9 in. Distance from center of spindle to under side of overarm, 7¾ in. Face of column to overarm brace, 25½ in. Pulley, 16 x 4 in. Motor recommended, 10 hp. Floor space, 126 x 116 in. Net weight, 7,270 pounds.

Storage Facilities Project for American Firms in Paris

Many American firms doing business in Paris, and especially those that are obliged to carry stocks of merchandise, are vitally interested in the question of warehousing and storage space. One of the first problems that confronts the American company beginning in France is that of stock storage and delivery. Most of them, when they first enter the field, are uncertain as to the ultimate volume of their business and consequently as to the amount of stock they must carry. Accordingly, in many instances, they are forced to carry small stocks in public warehouses of all kinds, incurring delays and difficulties—if not high prices—and are not able to use their warehouses as proper stockrooms.

The American Chamber of Commerce in France reports that it is in receipt of an interesting suggestion from Col. W. N. Taylor, European sales manager of the E. I. DuPont de Nemours Export Co., 282 Boulevard Saint-Germain, Paris, who says: "To solve this problem the only method at present is for each individual to undertake the maintenance of a storehouse, but in many cases the overhead involved is prohibitive. It would be of interest for members of the chamber to consider the possibility of a number of American houses forming a small company to maintain a warehouse, with a truck or trucks, for deliveries and for handling the stocks of the member companies. This would permit companies carrying a moderate-sized stock, or who are uncertain as to their proper stock volume, to enjoy the facilities of a stockroom, with access to and control of their merchandise in a manner more satisfactory than as at present in public warehouses."

How Do You Make Your Profits?

Small Profit on Large Turnover Easier To Get than Large Profit on Small Turnover—Average Return Is 15 to 20 Per Cent in Well-Managed Company

By W. R. BASSET
Miller, Franklin, Basset & Co.

THE most difficult part of formulating a business policy is to think straight and to discard the unessential. As the policy unfolds, we come upon branches and side issues which lead us astray. These ramifications of policy must of course be settled, but they can ordinarily be handled by the lesser executives of a business. The chief executive should quickly jerk himself back on to the main line if the resulting policy is to be clean-cut and profitable.

I therefore believe in first stating a problem in "words of one syllable" and then as the problem is attacked, checking myself to see that I do not stray. That is my excuse for making the trite remark that manufacturers are interested in getting the maximum percentage of profit on a given invested capital. It is astonishing how a man, unless he checks himself occasionally with this statament, will find himself judging his prosperity by some other test, such, for instance, as the percentage of net profit he is making on his sales. Though, of course, unless the sales price of a manufacturer's product carries an ample margin of profit, it is impossible for him to get a satisfactory return on his capital invested.

Average Return is Small

You may think that my statement that manufacturers want to get a high rate of income on invested capital is naïve; that it is too obvious to require stating. It has been my privilege to have quite an intimate knowledge of the affairs of something over 1,500 manufacturing enterprises, large, small and medium sized. I have more than once been surprised at the large number of these which return to their owners an income much less than the savings bank interest on the money invested. Even during the war years, there are hundreds of concerns which have returned less than 7 per cent on the invested capital. In other words, the owners of these concerns who had put from a few hundred thousand to a few million dollars into them, got less income than they would have had they put their money into bonds. I need not point out that the bond investment would have been better, for it would have cut the risk to practically nothing and would have enabled these hard-working business men to take it easy in some more pleasant climate.

In order to get vivid examples of how profits are made and are not made, I tabulated the affairs of fifty of my clients, representing thirty-five lines of industry, covering the years 1917, 1918 and 1919. As these were taken at random, including concerns which I know to be ably managed, others which are poorly managed, but the majority of which are run by manufacturers of average ability, it furnishes an interesting cross-section of the manufacturing industry. Of these fifty, seven in the year 1919 returned less income than could easily have been obtained had the money been invested in seasoned securities. On the other hand, there were two which returned more than 50 per cent on the investment. The average for the fifty showed an income of 18.55 per cent on the invested capital.

On this page is a tabulation showing the totals and averages for the fifty concerns. The individual figures bring out some very interesting points as to how the profits are made. Without exception, those concerns which show a high return on invested capital show a low percentage of income to total sales. In other words, the unusually high earnings are achieved by those concerns which take a moderate profit on each sale, but turn their entire capital rapidly. The highest turnover of capital shown on this tabulation is that of a concern having about half a million dollars invested, which took a profit of 3½ per cent on its sales in 1918, and 8½ per cent on its sales in 1919. In 1918 it made in round figures 30 per cent on its invested capital, and in 1919 85 per cent on its invested capital, which means that it turned its entire capital ten times in both of those years. Another concern achieved a turnover of ten with a profit of 3.6 per cent on the dollar of sale.

The Other Extreme in Turnover

At the other extreme are several concerns which do not make one complete turn of their capital per year. Every one of them takes a higher than the average profit on its sales but, because of the slow turnover, does not get a satisfactory return on the capital invested.

For ten years or more, retailers have been urged to increase their rate of turnover. It has been very thoroughly drummed into them that to be successful merchandisers they must take small profit per sale, but must turn their capital often. I think that, without exception, all notably successful retailers have built their business on this policy. Manufacturers have been slow to see the bearing of the same teaching on their business, although it is just as applicable. I do not mean by this that it is possible for all manufacturers to get as many turnovers of their capital as a retailer can. It is impossible in the machine tool business, for instance, where the average turnover, in normal times, of the most progressive manufacturers is seldom greater than one. You cannot turn over the money tied up in bricks, mortar and machinery. As a rule, the retailer has the bulk of his capital in liquid form. Most of his money is working capital rather than fixed capital. A great many retailers, in fact, have practically nothing in fixed

	1917	1918	1919
1. Invested capital	$97,173,127.10	$113,143,136.82	$127,690,357.41
2. Net sales	138,737,778.43	189,390,415.32	156,639,847.17
3. Turnovers	1.43	1.67	1.23
4. Per cent taxable income to sales	17.98	13.08	15.13
5. Per cent taxable income to invested capital	25.67	21.90	18.55
6. Per cent tax paid to taxable income	24.71	46.48	23.76
7. Per cent tax paid to sales	4.44	6.10	3.62
8. Per cent officers' salaries to gross income before deducting salaries	6.03	7.28	8.06

NOTE.—Items 1 and 2 are the total figures for fifty corporations in thirty-five industries. The rest of the items are averages for the fifty corporations. Items 6, 7 and 8 have no bearing on the subject discussed in this article, but are added because they may have an interest to executives who wish to compare the figures for their own business with those which are cross-sectioned through many industries.

assets. They rent their stores and their fixed assets consist solely of fixtures, ordinarily a small investment.

The manufacturer must of course have a plant and machinery. Inasmuch as this part of his capital is not in the cycle of trade, he must use every effort to get a rapid turnover of his working capital so that the return on his entire invested capital may be satisfactory. It goes without saying that in some lines of manufacturing an exceedingly large proportion of the total invested capital must be in plant and equipment. In other industries, much less need be tied up permanently. On the whole, machine shops require a heavier fixed investment than do most other industries.

The figures which I have tabulated show that, as a rule, the concerns with a low rate of turnover are those having a large investment in plant and equipment. Many of them have, to my certain knowledge, entirely too much tied up. Unfortunately, most manufacturers do not themselves pick their industry and start a brand new business with their own money. They are, in a manner of speaking, dumped into an existing business. A few inherit the business. More work up to the ownership from far down the scale. Usually, it is mere chance that starts them in one industry rather than another. They therefore have to accept certain adverse conditions ready-made. Were they to start a brand new business, many of them would mold it to better advantage, but in discussing policies we must assume that the conditions are very much ready-made. It therefore is not much help to tell a man that he has too much money invested in his plant and equipment. To help him, we must show him how he can earn larger profits with what he has.

Two Ways to Get Satisfactory Percentage of Return on Income

Now, there are only two ways in which a manufacturer can get a satisfactory percentage of return on his invested capital. The first and most desirable from all points of view is to take a fairly small margin of profit on each sale and to get a great many sales, that is, a high rate of turnover on his capital. The other way is to be content with a small number of turnovers and get an unusually high margin of profit on each sale.

First, let us decide upon what we shall consider to be a fair return upon invested capital. Those men who are in a settled, year-in-and-year-out business supplying articles of common consumption, such, say, as textiles, clothes and food products, are as a rule, well satisfied if they can make, year-in-and-year-out, from 10 to 12 per cent on the amount invested. In the machine-shop industry—and that of course covers a wide variety of products—most of the men I know feel that they should get from 20 to 25 per cent on the money they have invested. This is because it is much easier to have the entire investment wiped out by adverse circumstances and because the business is subject to more marked periods of depression.

Now, the figures I have tabulated show that the great majority of the fifty corporations had a rate of turnover which hovered fairly closely around 1 to 1½. That means that to get 25 per cent on the invested capital, each sale must carry profit of from 16 to 25 per cent. Probably 20 per cent would cover most cases. Unless a concern is in the fortunate position of having a monopoly of its market, it is not often able to make 20 per cent net on its gross sales. Competition takes care of that. In a competitive business, the only possible way that I can see by which anything like so high a profit on sales could be realized would be if every manufacturer accurately knew his costs and was determined to get a price which would return that profit. Unfortunately, there are but few manufacturers who get cost figures at all accurately, and a good many of those who do, do not put the trust in the cost figures which they should. Even though all the concerns in an industry operated under uniform and correct cost-finding methods, there would always be a few who would cut their prices below what would give them a fair return. Nevertheless, I believe that a long step toward proper profits is made when an industry adopts a uniform method of cost finding. When a manufacturer is once convinced that his costs are correct, he is less likely to sell at too small a profit. My experience shows me that price cutting is usually done by the man who is ignorant of his costs.

A 20 Per Cent Profit Is Exceedingly Difficult to Obtain in a Competitive Industry

On the whole, it is exceedingly difficult in a competitive industry to obtain a profit of 20 per cent on the sales. It is much easier to get a satisfactory return on invested capital by speeding up the turnover than by marking up the selling price. If a manufacturer has been making 24 per cent on his invested capital by turning his capital once a year and taking 24 per cent profit on his sales, he can get the same return on his investment with a 6 per cent profit on his sales if he is able to speed the rate of turnover up to 4. Difficult as that may seem, it has been done and I believe it is easier to do in most cases than to get, year-in-and-year-out, a 24 per cent profit on the sales.

There are several ways in which this can be done. I have said that many concerns have a disproportionate amount of their capital invested in bricks and mortar. It is my belief that most concerns are much overbuilt. In the first place, it is customary in building a plant to make it large and to supply capacity to handle 25 per cent in excess of the probable sales on a single shift. In other words, it is generally considered that machines will be active only about 80 per cent of the day shift. In those industries where it is possible to work two shifts, such a plant is twice too large. Many of the most profitable concerns I know designed their plants on the basis of handling their probable sales on 24 hours a day operation. That, you may say, offers a suggestion to the man starting in business and building a new plant, but is of no value to the man whose plant already exists. In individual instances that is true, but sometimes the manufacturer who is already in business will find that by added sales effort in normal times he can secure sufficient business to put his plant on two or three shifts. That will greatly increase his turnover. His sales problem of getting the additional business will be greatly simplified if he considers that on the increased turnover which he hopes to get, he will be able to take a smaller margin of profit. Speeding up the turnover reduces his costs and enables him to set a lower selling price in many ways. There is, first, this item of a smaller margin of profit per sale. There is also the fact that the fixed overhead charges of his plant will be less per unit of output as the activity of his plant increases.

A thorough study of manufacturing conditions within

the plant will frequently show ways in which the turnover of the working capital can be greatly increased. In one instance I know of, it was possible to increase the turnover of working capital of a machine shop manufacturing automotive parts from a rate of less than 4 to a rate of 15. The concern was selling about fifteen million dollars worth of its product a year. Its working capital had been $4,000,000, giving 3¾ turnovers of the working capital per year. By carefully planning the production so that the work in process was kept at a minimum, by cutting down the delays and increasing the output of machines and the machine activity this concern was able to get along on $1,000,000 working capital for the same amount of sales. In other words, by speeding up its production it got 15 turnovers of its working capital per year.

Lest you think that this is a case so unusual as to be not worth considering, I can say that I have seen the turnover rate increased three or four times in a dozen or more concerns. I have seen even greater increases in the turnover than this.

There are few factories in the machine-shop industry that could not greatly increase the speed with which work passes through. The manufacturer is too complacent about the slow movement of material. If one of his debtors takes thirty days too long to pay, he takes prompt action, but the same man will walk through his plant and see a truckload of parts worth $50 apiece sidetracked for no good reason, and will fail to realize that to all intents and purposes what he sees is a truckload of fifty-dollar-bills on vacation.

Every step in manufacturing needs attention if turnover is to be speeded up. The tools in the plant can be studied to see that they are in balance and that the progress of the work is not delayed by "bottle necks." The routing of the work can be studied in connection with the layout of machines so that time may not be wasted making unnecessarily long moves between machines and operations. Machines do not always operate at their maximum speed. Machines lie idle because it is not the business of someone having general supervision of production to see to it that work is available for that machine. It is not at all uncommon for one or two machines to be out of work while somewhere else in the plant there is work for those machines to do. Sometimes the individual workmen are not producing as rapidly as they should, because their operations have not been studied and proper standards of work set. Often proper jigs and fixtures can be provided which will enable workmen to increase the speed of production. There is no one point at which this problem can be attacked. The entire factory must be studied and betterments made wherever possible.

To my mind, the surest way to get a satisfactory return upon the invested capital is to speed up the turnover of capital. The possibility usually exists and the manufacturer who can get a satisfactory return on his capital on a narrow margin of profit has much less to fear from competition than the man who has to depend upon a wide margin of profit to offset his sluggish manufacturing.

Wide margins of profit invite competition, and potential competitors can smell wide margins as far as flies can smell molasses.

Shop Methods of Casting Locomotive Bearings

A Comparison of the Methods Used in Three Middle Western Railroad Shops—Wabash Methods Include Casting Hub Liners in Place

By J. V. HUNTER
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THE design of locomotive bearings upon certain occasions may be influenced by shop methods employed in the renewal of worn parts. Different methods of handling certain details were found in a number of shops visited and an analysis of the various ideas seen shows that an interchange of views may be helpful to other railroad shopmen.

The construction of the locomotive driving boxes of the Wabash Railway is undoubtedly the controlling motive that causes certain differences in the method of casting bearings, at the Decatur shops, from the methods used on other railroad systems. Where hub-liners are used on the inside of drivers it is the practice in some railroad shops to attach these by countersunk - head screws. Opposed to this method is the Wabash practice of counter-boring the driver hubs and casting a bronze ring in place.

The bearing casting is done in a portion of the main shop building, adjoining the driving wheel department, that is designated as the brass foundry. The bearing metal is melted in a horizontal tilting oil furnace, Fig. 1, which was built in the Wabash shop. The furnace has a steel shell with flanged steel end-plates and is detailed in Fig. 2. It has a gear drive for tilting it to the pouring position shown in Fig. 3. The shell is lined with fire-brick and

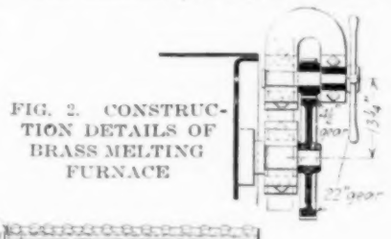
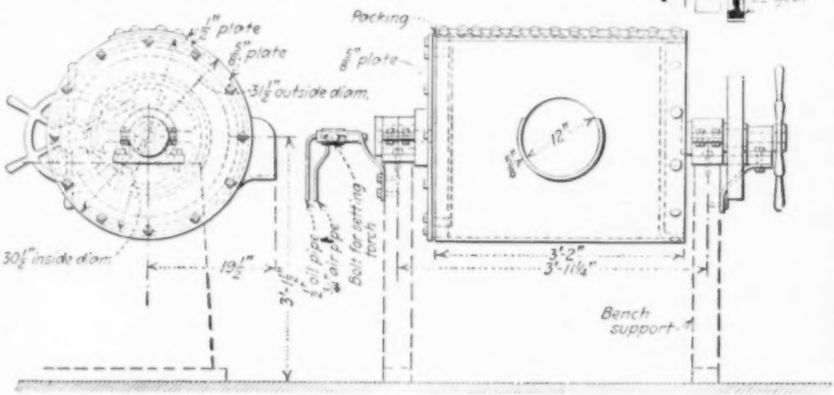


FIG. 2. CONSTRUCTION DETAILS OF BRASS MELTING FURNACE



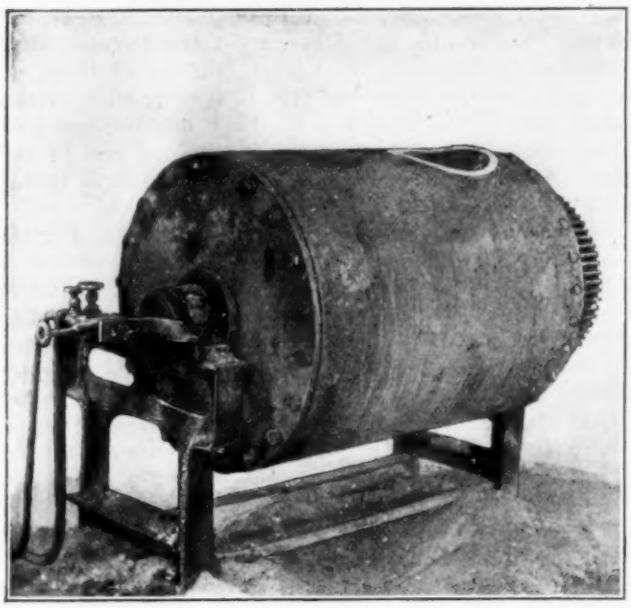


FIG. 1. OIL FURNACE FOR MELTING BEARING BRASS

its nozzle is coated with a ganister compound of crushed brick and fireclay. A graphite crucible, preheated by standing for a time in the flame from the furnace nozzle, is used for a pouring ladle.

A locomotive driving wheel prepared for pouring the brass hub-liners is shown in Fig. 4. The casting is made in an open-top mold constructed by surrounding the hub liner recess by the piece of band-steel *A* that is held together in circular form by the two spring clips *B*. The outside of the base of the band is daubed with fireclay to prevent run-outs. The axle is wound with a single layer of heavy asbestos yarn from the hub of the wheel to a point above that reached by the molten metal. The insulation serves in a measure to protect the micro-structure of the steel from the effects of the local application of heat. When the hub surface is rusty it is smeared with oil to prevent spattering of the molten metal.

FIG. 3. FURNACE IN POURING POSITION WITH LADLE

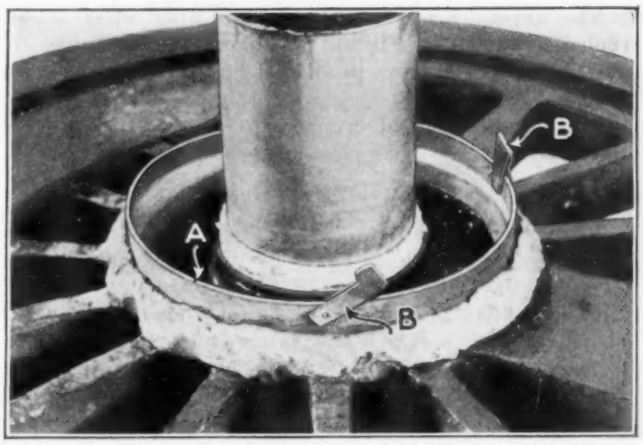


FIG. 4. DRIVING WHEEL WITH MOLD READY FOR CASTING HUB LINER

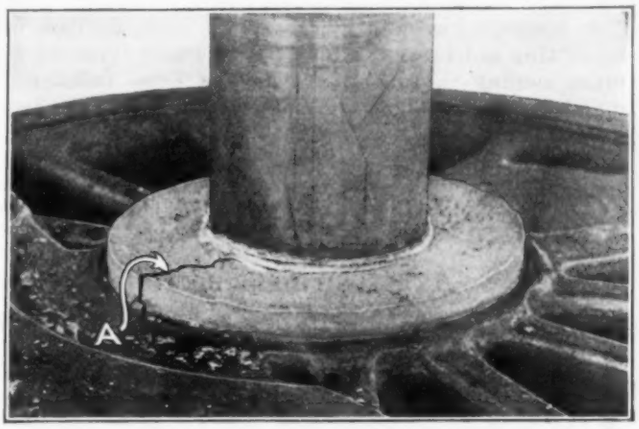


FIG. 5. CAST HUB LINER SHOWING SHRINKAGE CRACK

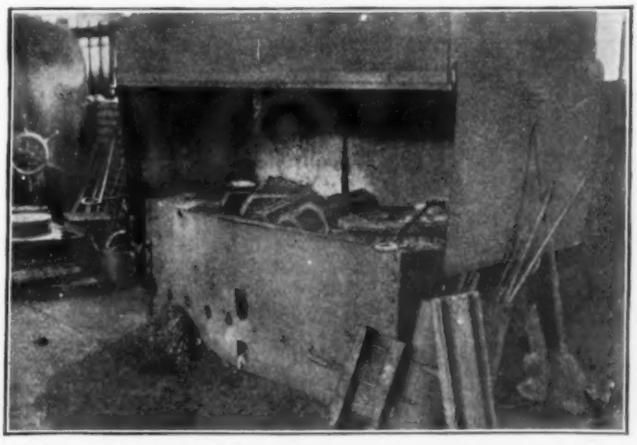


FIG. 6. BABBITT METAL MELTING FURNACE

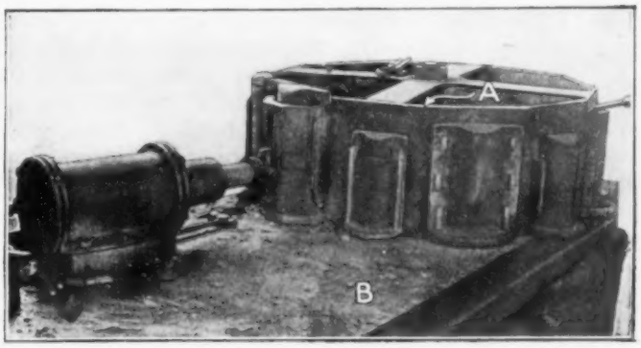


FIG. 7. REEL WITH BABBITTING MANDRELS AND PNEUMATIC CLAMP

The appearance of the cast hub liner after it has cooled is shown in Fig. 5. A shrinkage crack like the one shown at *A* occurs in all cast hub liners. The crack is taken care of by filling with babbitt so that after it has been machined off a smooth surface is left to run against the face of the bearing box.

The Babbitting Operation

Most of the babbitting is done in the same department, and this particularly includes journal brasses. The babbitt metal is melted in the furnace, shown in Fig. 6, which is heated by an oil burner. It has a melting pot at each end and a central pre-heating portion where the brasses are dried before melting off the old babbitt. The pot at the left is used for recovering old babbitt by dipping the worn brasses in the molten metal until the babbitt has melted off. The pot at the right is for melting the new and reclaimed metal for relining the brasses.

A labor-saving outfit, Fig. 7, has been devised for babbitting old brasses. Shops with many types of engines coming in for repairs have a large number of mandrels for rebabbitting the brasses. The mandrels are heavy and clumsy to handle and are apt to be mislaid. This trouble cannot occur at the Decatur shops because all mandrels, or at least fourteen of them, are mounted on the large reel *A*. It rotates on a vertical shaft held by the baseplate *B*. Each mandrel has a flat side that is bolted against the face of the reel by capscrews from the inside so that the mandrel face is smooth and flawless.

Only one brass may be babbitted at a time. For this operation it is clamped against the proper mandrel by the piston of the air-cylinder *C*, which in the illustration is shown holding a brass in position for babbitting. When so placed the cracks between the brass and mandrel are daubed with fireclay to prevent run-outs. When the babbitt has cooled the air pressure is released from the cylinder and the brass is removed. The air cylinder is radially in line with the center of the reel so that the thrust of the piston is directly against the center shaft. The reel can be easily turned to bring any mandrel to face the clamping piston and reduces the time lost in hunting mandrels in shops where the babbitting equipment is put away in odd corners and under work benches.

Methods at the Big Four Shops

Axle Bearings and Hub Plates Separate Pieces — Unusual Fixture Employing Double Air Cylinder

IN THE Beach Grove locomotive shops of the Big Four system at Indianapolis, Ind., variations from the methods of other shops are found in the practice of casting locomotive driver boxes. The axle bearing and hub-plate bearing are separate. The former is a finished casting that is pressed in its recess in the steel bearing-box. Later the hub plates are cast in place. The illustration, Fig. 1, shows at *A* an inside end of a driver box with the pressed-in insert *B* in place. The other two boxes *C* and *D* show the rough hub-plates as they appear after casting.

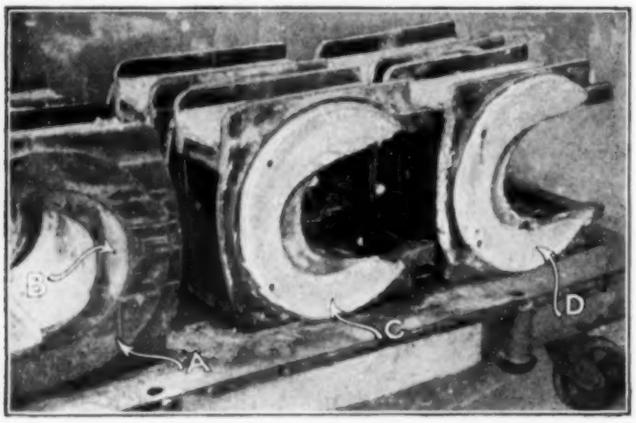


FIG. 1. DRIVING WHEEL BOXES WITH PRESSED-IN BUSHINGS AND CAST END PLATES

The axle bearings are pressed in under a pressure of from 20 to 30 tons by a special hydraulic press that was built in the Big Four shops.

The boxes are prepared for casting the end plates as shown in Fig. 2. The heavy steel ring *A* is laid on top, and daubed with fire-clay around the joints to prevent run-outs, thus forming a mold for the outside of the flange. Two pieces of sheet steel *B* on the inside, pasted up with fire clay, take care of the straight portions beyond the pressed-in bearing. The springs *C* hold the steel sheets in place. The face of the steel box is grooved to provide an anchor for the brass and in some cases the grooving is augmented by drill holes. The bearing bronze is melted in a Rockwell double-chamber tilting oil furnace.

Sandblasting the Brasses

Special attention has been given to relining journal brasses. These are first sandblasted in the cabinet-type sandblast device shown in Fig. 3. Sandblasting gives the inside of the bearing a thorough cleaning over the surface and in all retaining grooves and pockets and insures a firmer bond for the babbitt. Before sandblasting was used it was the practice to rebore the inside and recut the grooves on a shaper in order to get a clean surface. The new method has reduced the cleaning cost to a mere fraction of what it was formerly.

The sandblast cabinet has a hopper bottom with a chute *A* down which all the used sand falls into the bin *B* in the base of the frame. From the bin it may be replaced in the sand supply tank *C* located in a position some distance above the cabinet. The sand flows down the hose *D* to the blast nozzle *E* where it is caught by the jet of compressed air and blown into the cabinet. The exhaust air and dust can escape outdoors through the vent pipe *F*.

The journal-brass babbitting mandrels are mounted on a revolving reel in a manner similar to that noted in another shop. This inexpensive reel is shown in Fig. 4: it was made from an old iron pulley *A* with a flange *B* bolted to its bottom edge on which the brasses may stand. The babbitting device is a double affair; the

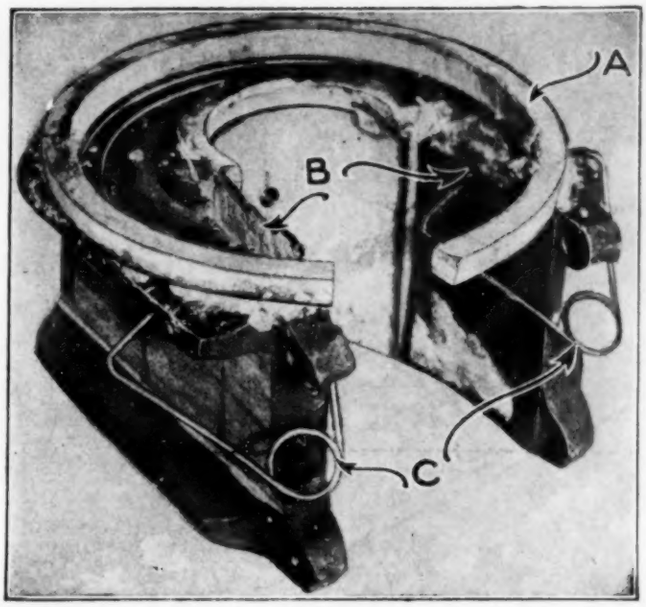


FIG. 2 BOX READY FOR CASTING BRASS HUB PLATE

large cast-iron reel *C* being provided for handling long mandrels. Midway between the two reels stands a double-end air-cylinder *D* with pistons at each end. A

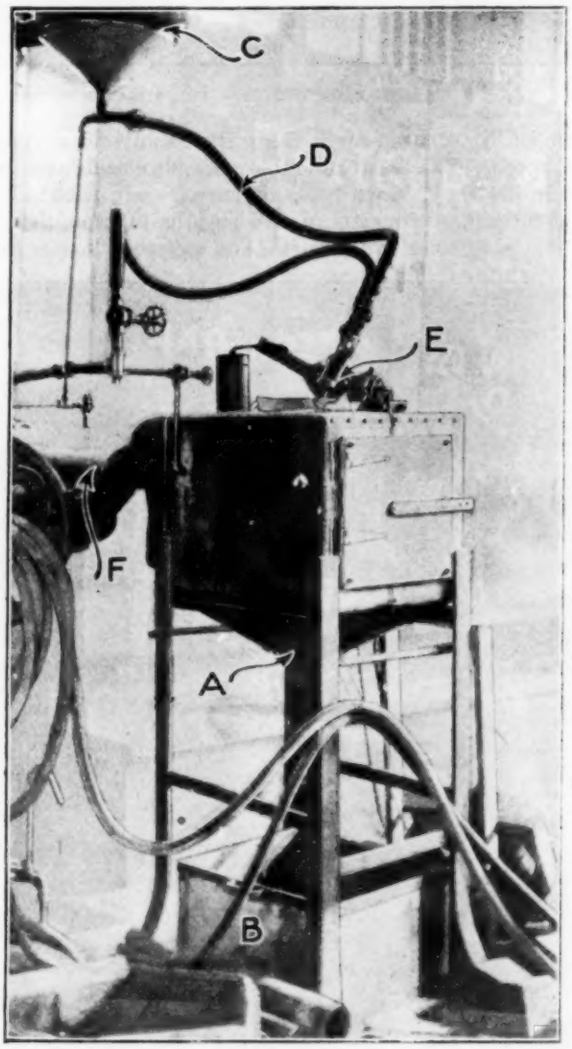


FIG. 3. SANDBLAST CABINET FOR CLEANING JOURNAL BRASSES

brass is clamped against the mandrel in the manner shown at *E*, while it is being poured.

In clamping the brass another unusual feature is

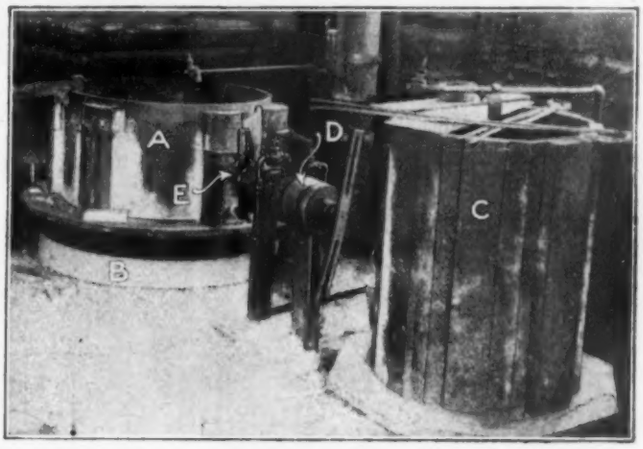


FIG. 4. REELS FOR CARRYING JOURNAL BRASS BABBITTING MANDRELS

employed because the bearing has two oil-holes drilled and countersunk in its back. It is desired to keep the holes clean from babbitt and avoid the necessity of redrilling and countersinking; and this is accomplished by the clamping head of the air-cylinder plunger shown in Fig. 5. The head consists of a slotted bar *A* in which two sliding screw-plugs can be adjusted and held by the thumbnuts *B*. The heads of the plugs are conical and can be adjusted to fit in the countersunk oil-holes. This provides two points of pressure for holding the brass firmly against the mandrel and also keeps the upper section of the oil-holes clear of babbitt. The oil holes are later pierced through the layer of babbitt by drilling.

The piston on the other end of the air cylinder *E* is provided with a slotted bar for clamping in the same

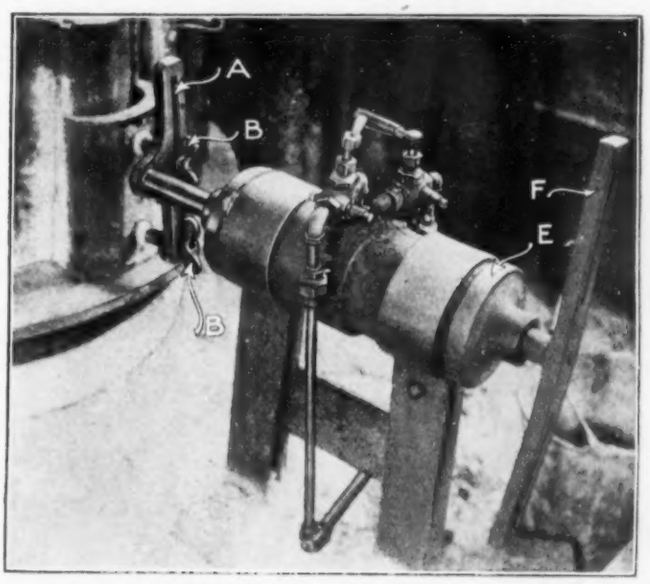


FIG. 5. AIR-CYLINDER AND CLAMPING HEADS FOR JOURNAL BRASSES

manner. The double air-cylinder is so constructed that air can be admitted to the cylinder at either end by means of the two air valves, and babbitting can be done on mandrels of both reels at the same time without interference.

Practice in the Chicago & Alton Shops

Gas Furnaces Used for Melting—Efficient Wire Mesh Anchor Spot Welded in Place

A NUMBER of novel features have been introduced in the practice of casting bearings in the locomotive shops of the Chicago & Alton Railroad Co. at Bloomington, Ill. In this shop city gas has replaced crude oil as the fuel for melting babbitt. The two gas-heated babbitt melting furnaces, shown in Fig. 1, have lately been installed, each with a capacity for 1,200 lb. of metal. Test runs made in the shop show that the furnaces can melt their full capacity of metal from the cold state in 23 minutes. This is a valuable feature as it enables the workman to start casting bearings earlier than customary in the morning. The furnace parts were designed and built in the shops and the gas burner installation was made by the local gas company.

Gas burners are also applied to the special device, shown in Fig. 2, used for melting the babbitt from crosshead shoes. This heating table was also designed and built in the shop. Two types of burners are used: The one at the left, *A*, consists of two lengths of pipe, drilled with suitable holes for gas jets, and extends clear across

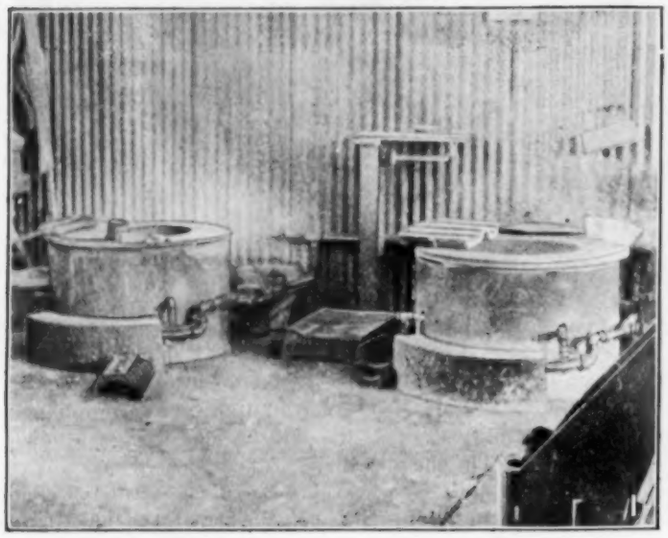


FIG. 1. GAS-HEATED BABBITT MELTING FURNACES

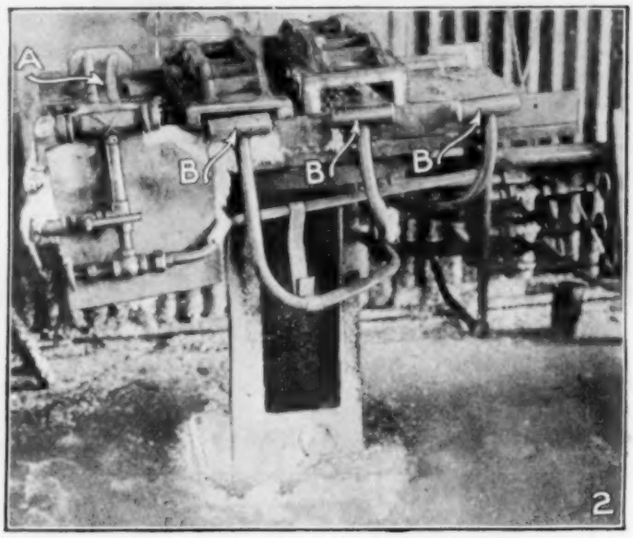


FIG. 2. TABLE FOR MELTING OLD BABBITT

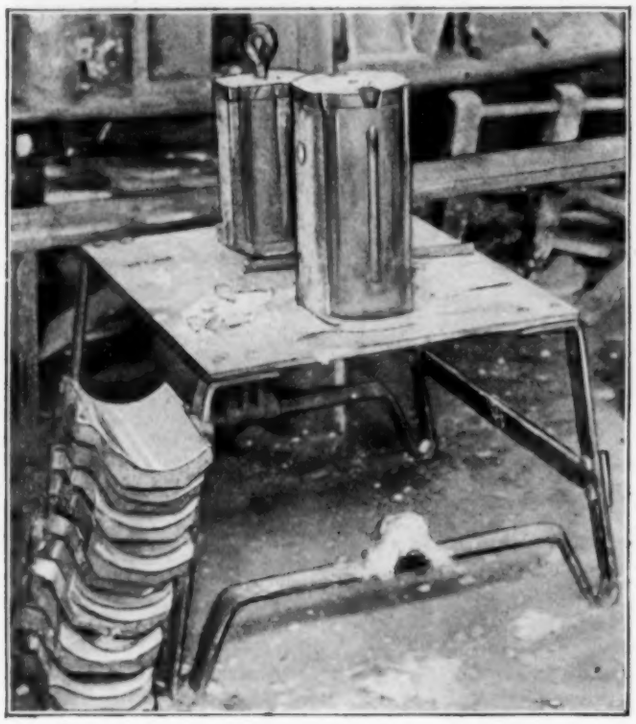


FIG. 3. STAND WITH MANDRELS FOR BABBITTING JOURNAL BRASSES

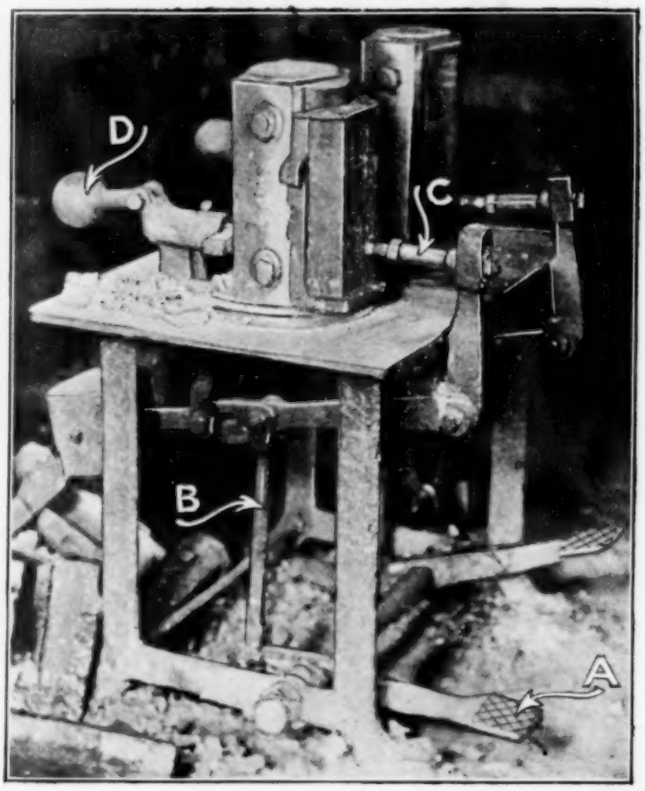


FIG. 4. JOURNAL BRASS BABBITTING MANDRELS WITH CLAMPING DEVICE

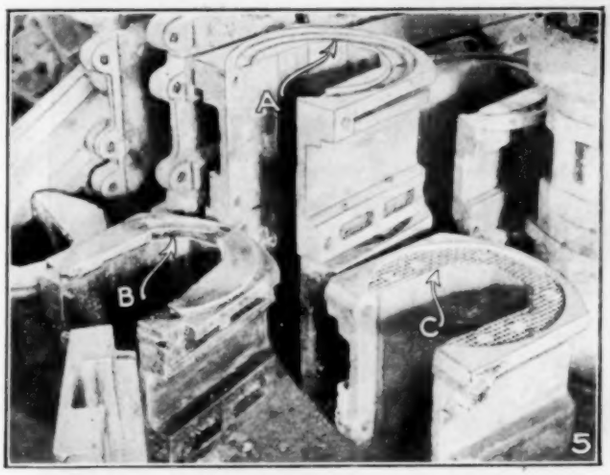


FIG. 5. GROUP OF BABBITT FACED DRIVING WHEEL BOXES

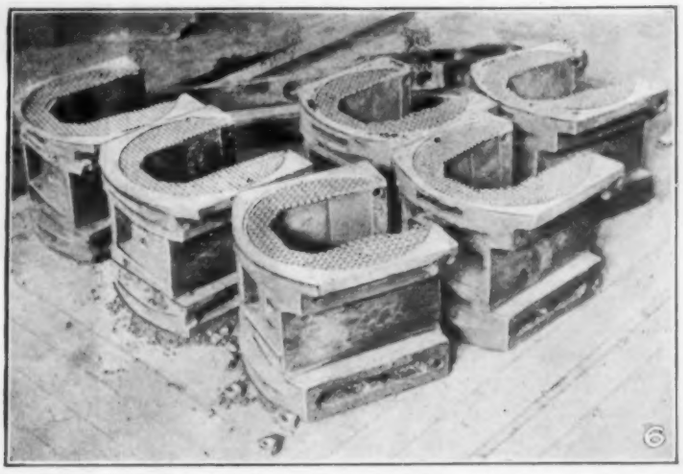


FIG. 6. DRIVER BOXES FACED WITH WIRE MESH READY FOR WELDING

the table. The other type burners *B* have heads with large gas holes that throw jets of flame across the table beneath the crosshead shoes being heated. The latter arrangement avoids the possibility of molten babbitt falling into the gas holes and shutting off the flame. The table is covered with a heavy sheet of asbestos board that protects its top and reflects the heat. The table top tilts toward the left, so that the molten babbitt will run off into a suitable receptacle.

Among the babbitting frames found in the shop is the one shown in Fig. 3. This has two solid iron mandrels mounted on a steel table. Brasses to be babbitted are held against flanges on the mandrels by screw clamps.

Another babbitting frame, Fig. 4, is more convenient to operate. Pushing down the foot lever *A* operates through the connecting arms *B* to hold the brass in place by the adjustable plunger *C*. The weighted lever arm *D* can be turned down to hold the pressure pin *C* in place after the lever *A* is released.

Retainer for Driver Box Babbitt

A development that has been made for retaining babbitt on the hub face of driving wheel boxes shows possibilities of its application in other fields. A comparison of the old and new methods of anchoring the babbitt to the box may be made from Fig. 5. The box *A* shows the old method of anchoring by cutting a dovetailed groove in the face and drilling a number of holes for additional security. This method has not proved secure, as is evidenced by the section of the hub plate that has broken away at *B*.

The new method of retaining the babbitt employs a section of heavy wire mesh as shown on the bearing box *C*. This wire mesh is of a grade and weight about equal to that used as a cinder screen in the smoke box. The face of the box has to be machined with a recess in which the screen can be inserted. The mesh is cut to the form indicated previously to being inserted. It is held in place by five or six spots where it is electrically welded to the steel box. The spots are each about ⅜ in. in diameter and show distinctly in the illustration.

In preparing the boxes with the wire mesh the latter is cut from large sheets, and a full set of boxes is made up at one time, as shown in Fig. 6.

The special tables shown in Fig. 7 are used for the babbitting operation. An empty table is indicated at *A* and two others at *B* have boxes in position ready for pouring the babbitt. A small pouring gate *C* is made of fireclay at the end of each box.

Two different practices of equipping driver boxes with bronze bearings were observed in this shop. One uses a pressed-in bronze journal bearing with bronze hub plates cast on the side of the steel box. This practice is seldom followed at the present time. The more common practice is to cast the bronze journal bearing and hub liner as one piece, and right in place in the box.

Before casting a mold is made up containing each box

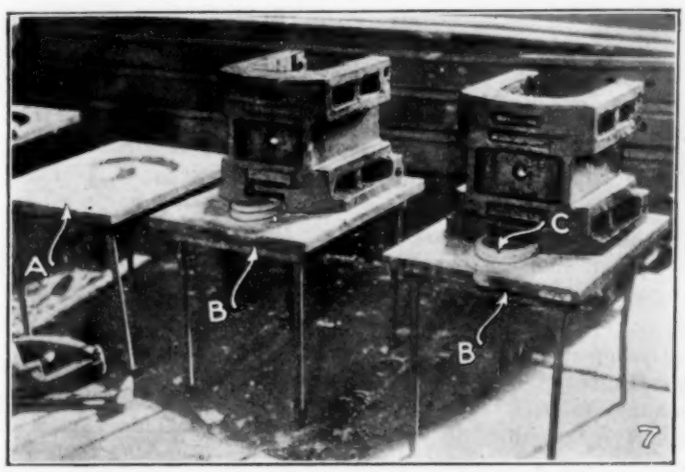


FIG. 7. BABBITTING STANDS FOR DRIVER BOXES.

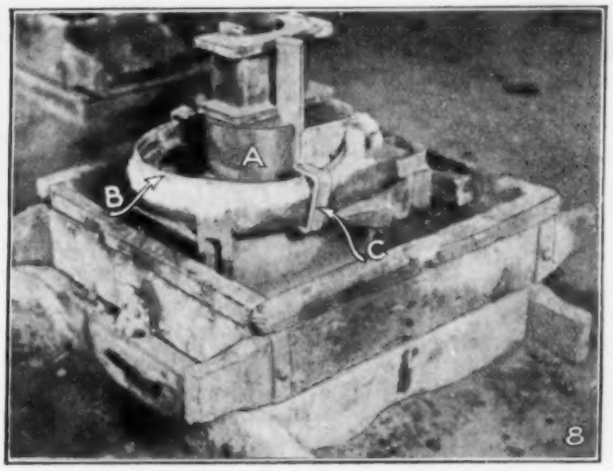
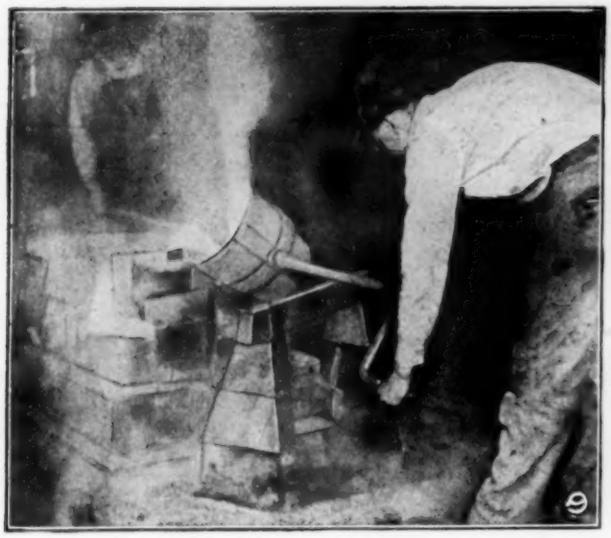


FIG. 8. DRIVER BOX IN MOLD FOR CASTING BRONZE BEARING



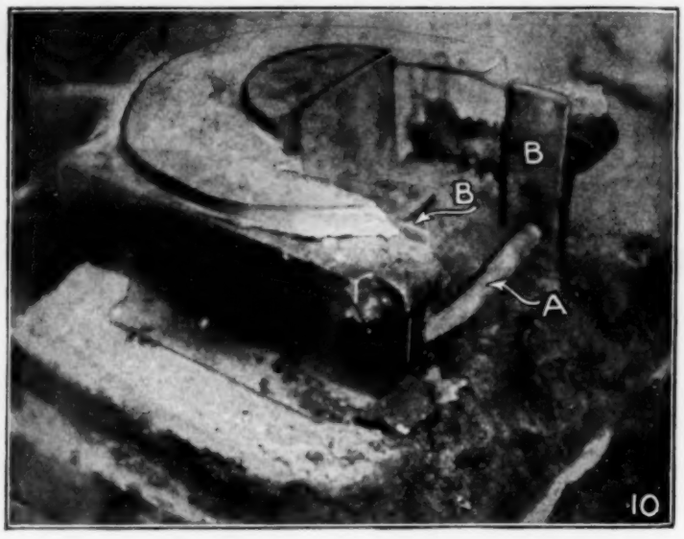


FIG. 9. POURING BRONZE BEARING IN DRIVER BOX, SUPPORTING THE LADLE ON TRESTLES. FIG. 10. BOX FITTED WITH SPACING BLOCKS TO CONTROL SHRINKAGE

and surrounded by an old foundry flask in the manner shown in Fig. 8. The steel bearing box rests on a sand slab-core, which makes the bottom surface of the bearing. Formerly an iron plate was used as a chill for the

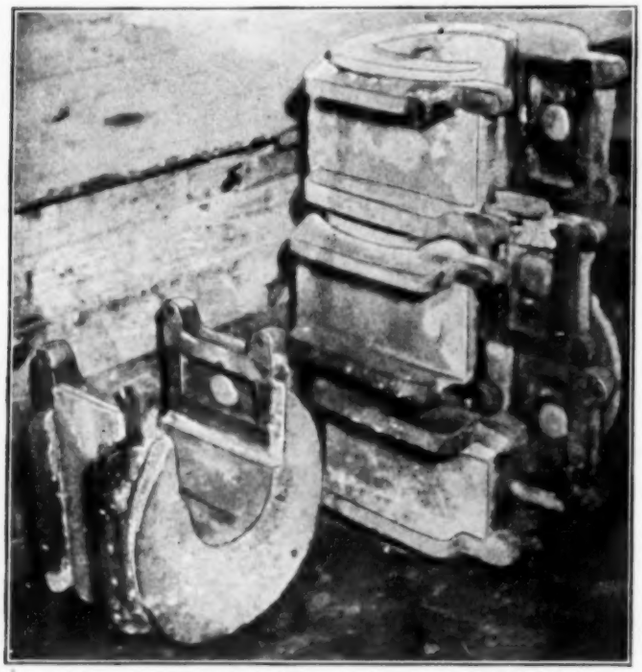


FIG. 11. GROUP OF BRONZE LINED DRIVER BOXES

bottom surface but this was found objectionable because the molten metal cut into it while being poured. A dry sand core *A*, coated with plumbago wash, forms the inside of the journal bearing. It is held in place by molding sand rammed against its back face and weighted down to prevent it from floating up on the molten metal. Steel strips *B*, clamped to the box by small C-clamps *C*, form the edges of the open-top mold for the hub plate. The joints are daubed with fireclay to prevent run-outs.

The bearing bronze is melted in a tilting oil furnace built in the shop. It is dumped from the furnace into a double-shank ladle and carried to the mold. The pouring operation is shown in Fig. 9. Some bearings may require nearly 250 lb. of metal, so trestles are provided for sustaining the weight of the ladle while pouring.

Method of Correcting for Contraction

The expansion of the steel bearing boxes as they absorb the heat from the molten bronze causes the open sides to spread considerably apart. In some cases the spread amounts to as much as $\frac{3}{4}$ in. As the steel box contracts on cooling it compresses the slower cooling bronze interior and tends to put a permanent set in it. The effect of this is that after the steel box has finished contracting the bronze bearing casting still further contracts. The final contraction of the bronze has occasionally been found to leave a space between the steel box and the bronze casting after both are cold. The permanent compression of the hot bronze casting is prevented by the temporary insertion of a spacing block as shown at *A*, Fig. 10. All boxes are carefully measured before pouring casting, and a steel bar *A* together with the necessary spacing blocks *B* are selected to fit each job. The combined length of the bar with the spacing blocks on its end is $\frac{3}{8}$ in. greater than the space between the jaws of the cold box.

As soon as the bronze casting has set (and while it is still red hot) the mold is knocked away as shown in the illustration and the spacing bar and blocks are inserted. As the steel box contracts a point is reached where further closing of the jaws is prevented because the bar takes up this pressure. This permits considerable cooling of the bronze bearing without the compressive strains induced by the steel box. After 15 to 20 min. the steel bar is knocked out and the two parts are permitted to finish cooling together. By that time the spacing bar has done its work and the shrinkage of the two pieces is so uniform that no opening will appear between the two bodies. It is stated that the steel box shrinks sufficiently around the bronze bearing so that it is very tightly gripped. In this shop the spacing bar used is uniformly $\frac{3}{8}$ in. greater than the opening of the jaws when cold. A group of completed bearing boxes with cast bearings is shown in Fig. 11.

(Editor's Note: The foreman of another locomotive shop states that he has followed a very similar practice. However, he has found that the length of the spacing blocks, used between the jaws of steel driver boxes, must vary acording to the size of the box. This variation increases by one-sixteenth inch for each one inch increase in the diameter of the journal bearing.)

Press Tools for a Typewriter Part

Two-Stage Blanking Tools—Work Divided Between Two Sets of Tools—First Operation Provides Means for Accurate Location for Final Blanking

BY FRANK A. STANLEY

THE engravings illustrate a set of press tools used in the manufacture of a ball spacer for a typewriter and were made in the toolroom of the Smith Premier Typewriter Co., Syracuse, N. Y.

A detail of the ball spacer is shown in Fig. 1 formed

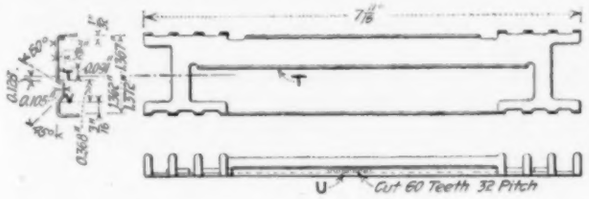


Fig. 1

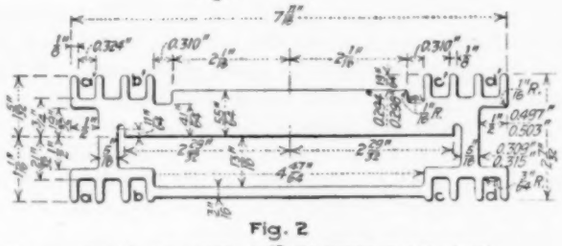


Fig. 2

FIG. 1. BALL SPACER COMPLETELY FORMED
FIG. 2. BLANK FOR BALL SPACER

and complete in respect to press operations. Fig. 2 shows the blank ready for forming. The blanking dies which perform the first operation of making the blank to the outline shown, but which do not pierce out the central rectangular opening, are illustrated in Fig. 3. These dies are really two-stage tools in that they are

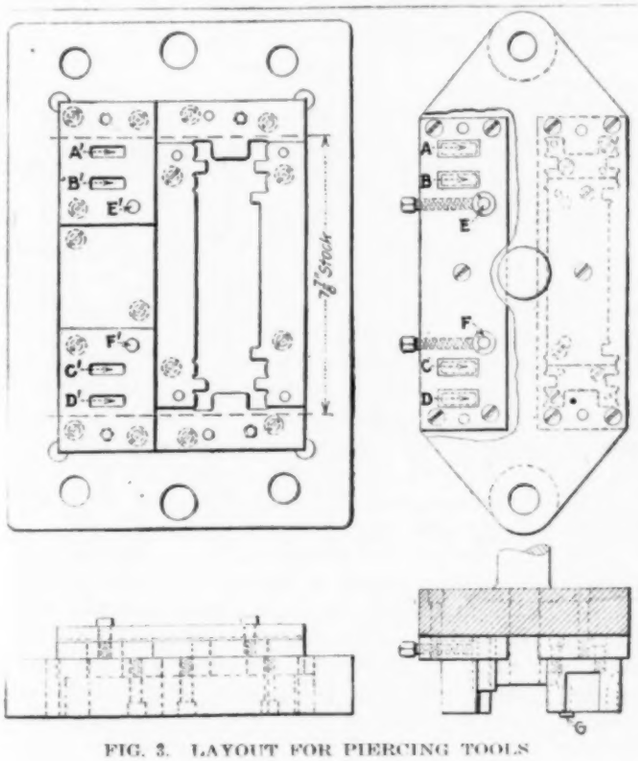


FIG. 3. LAYOUT FOR PIERCING TOOLS

made to pierce out certain openings exterior to the blank itself before the stock feeds under the blanking punch proper, thus simplifying the character and work of the real blanking dies. Note that four piercing punches are located at *A*, *B*, *C*, *D*, and four corresponding die openings at *A'*, *B'*, *C'*, *D'*. Also that the round piercing punches at *E* and *F* and die openings *E'*, and *F'* for punching the two ⅜-in. holes by which the stock is located in its second position by pilots *G* for the punching out of the entire blank.

The four die openings *A'*, *B'*, *C'*, *D'*, are rectangular in form and of a width to suit the four outer notches in each group of six at the ends of the blank, Fig. 2. These notches are in Fig. 2 designated by the characters *a*, *b*, *c*, *d*, *a'*, *b'*, *c'*, *d'*. Referring to the sketch, Fig. 4, the operations on the sheet metal are shown in the two positions. First the four rectangular holes *A''*, *B''*

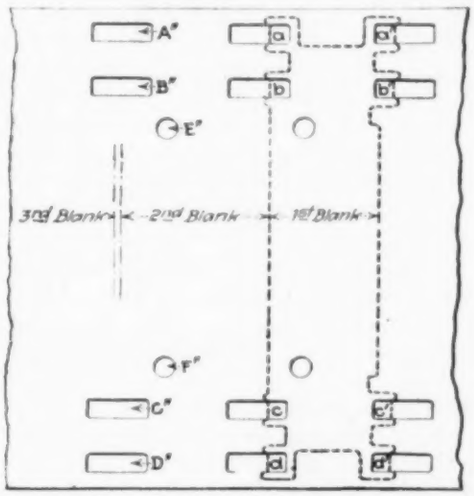


FIG. 4. DIAGRAM OF PIERCING OPERATIONS

C'', *D''*, and the two holes *E''*, *F''*, for the pilot pins are punched. The stock is fed forward one position and the blanking dies then cut out the blank to the outline indicated by the dotted lines. That is, this is the first blank. The same stroke of the press that blanks out this piece, also pierces the pilot holes and the four rectangular notches at the rear edge of the second blank. The rectangular punches at the same time pierce four rectangular notches for the front or leading edge of the third blank. Thus when the first blank is punched out the four notches at the leading edge of the second blank are cut across and left open, and so on with each step. Now the effect of the preliminary piercing out of the rectangular slots which form four of the openings or the inner edges of the prongs at each edge of the blank, is to reduce the work on the blanking die and to eliminate the long narrow die openings and punch sections that would otherwise be required to blank out the series of prongs on the work. The tools are thus simpler to make and keep in condition, and there is less likelihood of the blank edges dragging and becoming distorted in the dies. Examination of the die opening

in Fig. 3 will show at once how the outline is simplified by the addition of the rectangular piercing tools at *A, B, C, D.*

Reference has been made in other articles on press

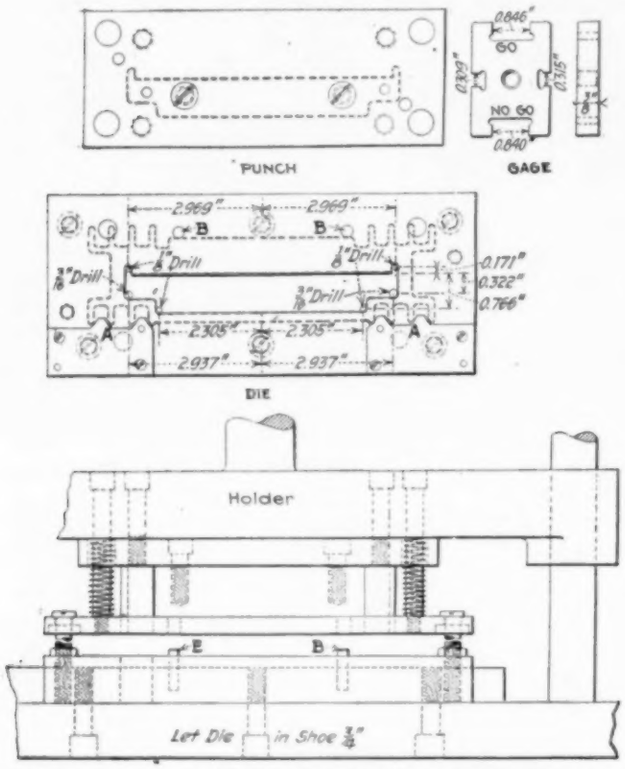


FIG. 5. PIERCING TOOLS FOR CENTRAL OPENING AND RACK SURFACE

tools to the practice in some shops of locating all die openings by small holes drilled at the corners, at the tops and bottoms of prongs and teeth, and so on; these holes defining accurately the general outline of the die opening. With the usual toolroom equipment, the milling machine with vernier attachments is used for getting the center distances for the holes or some method of using size blocks or other gages is applied. At the plant referred to a precision drilling machine is used

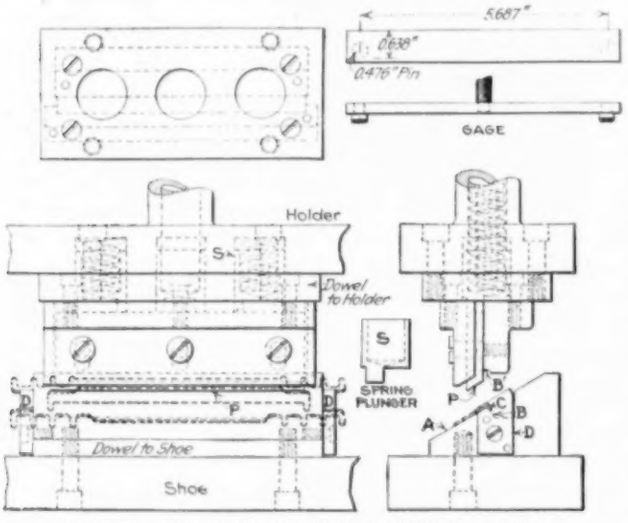


FIG. 6. FIRST OPERATION FORMING TOOLS

under which die layouts are very accurately handled. Thus in Fig. 3 a diagram is included at the right which is known as the precision layout. This gives the positions in two directions of all holes to be drilled in the die blank and with the work and machine once set, the positions for successive holes are quickly and accurately obtained by adjustment of the table slides in the required directions.

The dies shown in Fig. 5 are piercing tools for punching out the central opening and rack teeth surface in the spacing rack. Like the other dies in the equipment they are of the pillar type with two guide posts, one at each end, for aligning the punch head positively with the die shoe. The blank is nested against two steel blocks *A A* which have two V's each to enter between two pairs of prongs at each end of the blank, and there are two pins *B B* at the opposite side of the die to act as nesting pins for the straight surface along the other side of the blank.

The punch proper is secured to a steel base plate by two screws and two dowels and the latter plate is attached to the punch head or holder by four screws and two dowel pins. The combined pressure pad and stripper carried by the punch is held by four long screws on which pressure springs are mounted. The die is secured to its shoe by screws and dowels as indicated.

The limit snap gage at the right is a tool that should be used more commonly in press room work. With this gage the width of metal along the side and ends of the blank is tested and definite tolerances are thus provided so that the press work can be held within the prescribed limits, and wear on the dies can be permitted up to the point established by the gage dimensions when the press tools must be adjusted or replaced.

The first operation forming tools are illustrated in Fig. 6. These dies bend up the bar at *T*, Fig. 1, to a

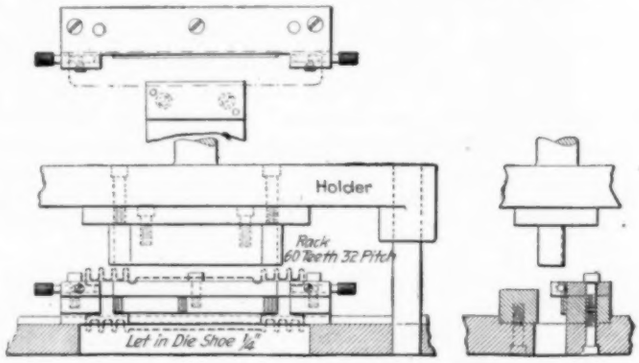


FIG. 7. TOOLS FOR RACK TEETH

right angle to the body of the blank and prepare this portion for the finishing of the rack teeth along its length. The die instead of being made with the customary flat face is provided with a 30-deg. sloping face *A* and the inner face over which the work is formed is made at a right angle to *A*, as shown at *B*. The forming portion of the punch as seen at *B'* is made at a corresponding angle. The bent down or formed portion of the work itself will be noticed at *C*. The work is located between end stops *D, D*, and rests upon the upper shoulders *E* of these stops.

There are various advantages in placing this die face at the angle shown instead of having it in a horizontal plane. In the first place the work drops naturally into place on the inclined face and rests against the stop surfaces *E* on *D, D*. Secondly, the punch and die faces for the forming operation being at an angle allow the work to be bent down naturally and the corner of the metal is not touched until the punch reaches its lower

position when it sets the corner and formed surface dead square to the body of the blank. Now, if the die face were flat as usual, and the forming portion of the

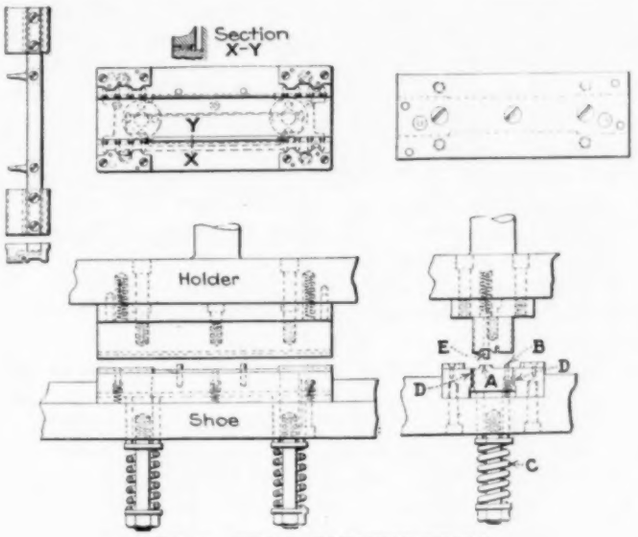


FIG. 8. FINAL FORMING TOOLS

punch perpendicular, the action of the punch would be to strike near the bending corner first and then in folding the metal down to a right angle there would be a tendency to stretch and draw it with possibility of slight distortion at least. This is avoided in the construction shown, and the forming face of the punch having the slope shown can force the work snugly down to the anvil-shaped portion of the die corner and "set" the metal accurately to form.

Then too, the sloping face of the die and the corresponding face of the pressure pad *P* assure the latter forcing the work down against the stop-shoulders and holding it there positively during the forming operation.

A detail of one of the spring plungers *S* of which there are three for the pressure pad *P*, is shown. These plungers are bored out from the top to receive the springs and the bottoms are milled off to form a tongue $\frac{3}{8}$ in. thick which enters the opening in which the pad is carried and so acts upon the upper edge of that member. The pad is slotted through the body to allow three shoulder screws to pass through to retain the part in place and still provide for about $\frac{3}{4}$ in. up and down movement in the punch body.

The dies shown in Fig. 7 are for the rack teeth *U*, Fig. 1. There are 60 of these teeth, 32 pitch. The narrow flange or ledge *T* has been bent up to a right angle as explained in connection with Fig. 6. In the dies shown in Fig. 7 the work rests on the flange *T* with the body of the piece in upright position as indicated by the front elevation.

The final or finish forming dies are shown in Fig. 8. These tools form up the right-angle flanges along the edges of the work and also form the V-shaped channels at *V*, Fig. 1. The drawing is in the main self explanatory. The work is nested between the V-shaped stops at the ends of the die proper and in operative position it rests upon the V-portion of the die at *A* and upon spring pins *B*. The die is of the compound order and as the punch descends the V-channel is formed over portion *A* of the die and continued downward pressure then causes die block *A* to descend against the action of pressure springs *C* and the flanged edges of the work are then formed up along edges *D* of the die proper. On the return stroke member *A* being forced upward by the under springs acts as an ejector and the spring pins *E* in the punch also act as stripper or shedder pins to clear the formed work from the punch.

Burnishing Broaches

How to Make and Use the Broaches—Kinds of Spoiled Work That May Be Reclaimed by Their Use—Turning Broached Work With a Diamond

BY E. A. DIXIE

IT IS SURPRISING how little knowledge there is among mechanics regarding burnishing broaches. Not only are they easy to make and use but a knowledge of their application often means the saving of a job which has been made too small or too large.

The use of burnishing—or as they are often termed "button" broaches is comparatively old. The writer used them nearly thirty years ago and their use at that time was old to the mechanic who showed him how to make them.

As far as known to the writer there are but two types, those with narrow "buttons" and those with wide ones. In Fig. 1 are given the dimensions for the narrow button type from $\frac{3}{4}$ to 2 in. inclusive. And in Fig. 2 are given the dimensions for the wide bulb type from $\frac{3}{8}$ in. in diameter upwards.

Burnishing broaches should be made of a good grade of carbon steel, hardened and drawn *slightly*. After hardening they should be ground and if a very fine surface is required on the work they may be lapped. While they should preferably be made of carbon steel, high-speed steel and also machine steel are suitable for this work. If made of the latter they should be carburized at least $\frac{1}{16}$ in. deep.

The grinding may be done either with a formed wheel or by using a fixture whereby the wheel can be swung to the desired circle. When grinding them on the ordinary cylindrical grinder a formed wheel should be used and when grinding them on the bench lathe a small wheel may be used driven from over-head and held in a swiveling fixture to give the bulbs the correct curve.

When grinding on the cylindrical grinder a male broach is first ground in the same way that a plain cylindrical piece is ground. The two ends are ground 0.001 in. less than the size of the smallest bulb of broach. The four large bulbs are next ground all the same size and 0.002 in. larger than the nominal size of the broach. The bulbs which comprise the tapered length of the broach are then ground tapering just as a tapered mandrel would be ground.

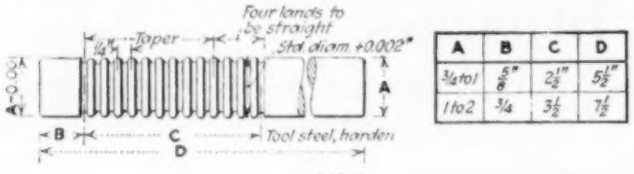
The form-grinding wheel for shaping the bulbs is now mounted on the spindle, trued up and dressed to the desired curve with the diamond. The corners are then rounded as shown in Fig. 3 so that the junction of the

bulbs will not be a sharply defined groove but a distinct curve. The reason for this is that cracks are very liable to develop if the grooves are not properly rounded.

With the wheel properly dressed to shape, the grinding machine operator starts at the first or smallest bulb and feeds the wheel into the work till he has almost removed the flat (left by the previous grinding) from the top of the bulb. He then moves the work or wheel to the next bulb and does the same thing, just leaving a narrow flat on top of each bulb untouched by the formed wheel. When all the bulbs have been formground in the same way the broach is in usable condition. If however a very fine smooth-working broach is desired he can go a step farther and lap it. This can be done with a lead lap cast on the broach or a piece of wood which makes a very good substitute. Fig. 4 shows an easily made wooden lap which gives good results. It must be remembered that only the *tops* of the bulbs are in contact with the work under working conditions; it is therefore not necessary to obtain a high polish on any other parts of the bulbs.

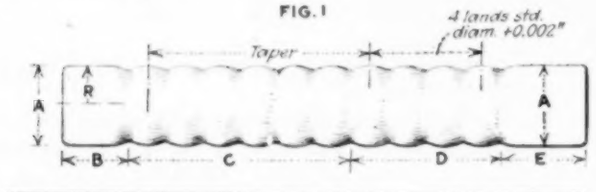
Referring to Fig. 4, *A* and *A* are two soft wood handles. To these, two *end-wood* pieces of hard maple *B* are attached by screws. A strap hinge *C* is secured about as shown. After the whole has been assembled a piece of wood about ¼ in. thick is placed between the hard wood pieces *B*, the handles *A* are tied together with a piece of string and a hole *D* about the diameter of the broach is drilled through the hard wood pieces. The insertion of the piece of ¼-in. wood between the hard wood pieces before drilling permits the two halves of the wooden lap to be closed on the broach during the lapping operation.

After the hole is drilled the two pieces of ¼-in. wood are removed. The ground broach with a dog on one end is now placed between centers in the lathe and the lap is closed in it while it rotates. This wears a series



A	B	C	D
¾ to 1	⅝"	2½"	5½"
1 to 2	¾	3½	7½

FIG. 1



A	B	C	D	E	R
Standard −0.001"	1"	4 to 6 bulbs in length	4 bulbs in length	To suit work	Radius of bulb = ½ diam. of broach

FIG. 2

FIG. 1. DIMENSIONS OF BURNISHING BROACHES FROM ¾ IN. IN DIAMETER. FIG. 2. DIMENSIONS OF BURNISHING BROACHES FROM ¾ IN. IN DIAMETER UP

of grooves in the hard wood. These grooves for the reason previously given need not be very deep, ⅛ in. being quite enough for a start for they will soon wear deeper when the abrasive is applied. Almost anything in the way of an abrasive will do, emery, alundum or carborundum with oil, but it should be fine enough to give the required finish. If carborundum is used I would suggest nothing coarser than 15 minute. For producing a very fine finish 65-C alundum gives very fine results, but the lapper must always remember that he cannot start with a coarse abrasive on a lap and then use finer abrasive on the same lap and get good results.

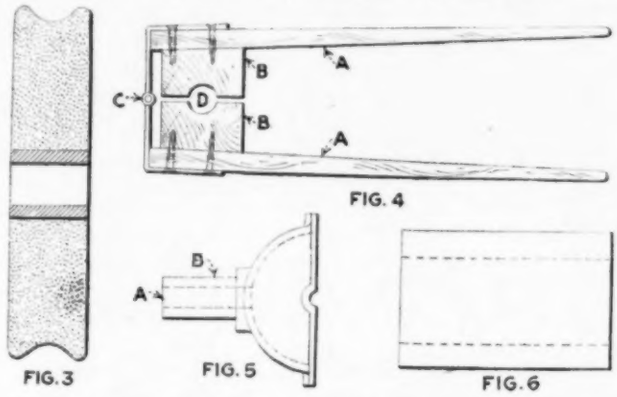


FIG. 4

FIG. 3

FIG. 5

FIG. 6

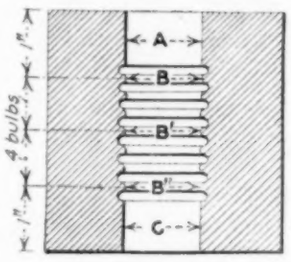


FIG. 7

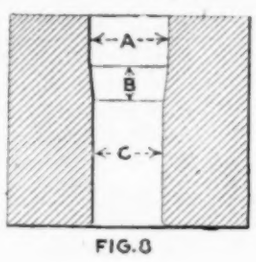


FIG. 8

FIG. 3. SECTION OF WHEEL FOR GRINDING BULBS. FIG. 4. LAP FOR BURNISHING BROACHES. FIG. 5. JOB TOO SMALL RECLAIMED BY BURNISHING BROACHES. FIG. 6. JOB TOO LARGE RECLAIMED BY BURNISHING BROACHES. FIG. 7. INTERNAL BROACH, WITH BULBS. FIG. 8. PLAIN BURNISHING DIE

He must keep his coarse laps for coarse abrasive and have fine laps for fine abrasive. A single grain of coarse abrasive on a fine lap will ruin the work of that lap.

When lapping the broaches the operator should keep his eye on the job and not run long without removing the lap, washing the broach with gasoline or kerosene and examining it very carefully to see that he has not lapped it too much. All it needs is to have the grinding marks removed and this only when an exceptionally fine broach is required. For the ordinary run of work the broach can be used just as it comes from the grinding machine.

And now a word on the uses of burnishing broaches.

Burnishing broaches can be used for reclaiming work which is too small in outside diameter providing the hole is also small; for reclaiming work which is too small in the hole providing the outside is over size but their greatest usefulness is in the production of work such as bushings of almost exactly uniform inside and outside dimensions.

Reclaiming work which is too small in outside dimensions is done as follows: As an example I have selected a job in the automobile industry. In Fig. 5 is shown a part of a differential of which many thousands are turned out in the United States each year. The limits on the stem *B* are pretty close and in the bustle of production a fairly large percentage of them are turned too small. There is however nothing very particular about the size of the hole *A*. This being the case a burnishing broach can be forced through *A* and if the broach is made large enough it will expand the stem *B* and make it large enough to finish to correct size.

Reclaiming a piece which is too large in the hole is

done as follows: As an example I have chosen a job, Fig. 6, of which about 300 had been reamed by a cub apprentice, with a reamer three or four thousandths over size, before someone noticed what was wrong. To avoid the expense of scrapping the lot the external burnishing broach, shown in Fig. 7, was made. Before putting the bushings through this broach they were turned five or six thousandths over size in diameter. The dimension *A* of the broach, Fig. 7, was made about 0.001 in. larger than the turned bushings. The dimension *B* was the same size as the bushings, and the diameters of the internal bulbs, if I may use the term, gradually decreased till at *B1* they were about 0.005 in. smaller than the required finished size of the bushings. From *B1* to *B2* at least four lands should be the same size. Pushing the bushings through this internal burnishing broach reduced the holes so that they could be finished with a standard reamer. It was found on pushing the bushings through the hole which was 0.005 in. smaller than the required size that when released from the internal broach they expanded enough to bring them about 0.001 in. smaller than standard size. Internal burnishing broaches need not have bulbs unless there is (as in this case there was) an excessive amount of closing to do. For the ordinary run of work where there is, say only two thousandths or so to contract, a plain die as shown in Fig. 8 will do the job all right. The dimension *A* is made about 0.001 in. smaller than the work; it is a receiver for the work that among die makers is termed a "set edge."

The part *B* is tapered from the dimension *A* to the dimension *C* which is the finished size of the work *less the amount the work expands after it is released from the die.* The amount of expansion will have to be ascertained by experiment for it will vary with the thickness of the wall and the material from which the work is made.

A die of this kind to produce nice smooth work should be finished to a high polish and the work should usually be well lubricated before it is pushed through.

As previously stated the greatest use for broaches of the types shown is for producing bushings of the highest accuracy and finish. I recently went over a plant in England where the product is bronze bushings. They were just plain cylindrical pieces of bronze with a hole through them, but the holes were straight and round and concentric with the outside, and the bushings were a drive fit for a standard size hole in a machine frame.

Let us take as an example a standard size made by this firm, 1⅛ in. outside diameter, 1⅝ in. long, with a standard ¾-in. hole from end to end.

The old method of making such bushings was as follows:

The bushing casting was held in a combination chuck in the lathe. The hole was drilled, bored and reamed, and the front end faced. The bored bushing was then pushed on a floating mandrel in another lathe and the other end faced and the outside turned 0.015 in. oversize for grinding. The last operation was to push the bushing on a floating mandrel in the grinding machine and grind the outside a grinding fit for the standard 1⅛-in. hole. The last operation requires not only skill but care and a fairly large percentage of bushings were scrapped from this operation.

The method now employed for producing these bushings is as follows:

The bushing is chucked as before in a combination chuck and the ¾-in. hole bored and reamed and the end of the bushing faced. The bushing is then transferred to the floating mandrel and turned about 0.002 in. over size and the other end faced. After the bushings have been brought to this stage of completion they are taken to the arbor press where they are pressed one at a time into a hardened and ground steel die similar to that shown in Fig. 8. The straight part of this die is about 1¾ in. long. Before they are pushed out of the other end of the die a burnishing broach ¾ in. in diameter, made like Figs. 1 or 2, is pushed through the hole in the center of the bushing. Pushing the 0.002-in. over size bush into the die closes the reamed hole nearly 0.002 in. and affords that amount of stock for the burnishing broach to work on. After the ¾-in. burnishing broach has been pushed through, the surface of the hole is very highly polished. The bushing is then pressed out through the other end of the die.

These two operations take considerably less time to perform than to describe.

If the burnishing die is made the same size as the holes in the machine frame which later are to receive the bushings one can rest assured that after the bushings have been forced through the die they will press snugly into the holes in the machine frame. The arbor press job is handled by an apprentice or a laborer, practically no skill is required and it is next to impossible for the operator to make a mistake. If the bushings are placed in the "set edge" and pushed through they can't help being perfect when they are ejected from the die.

Passing through the die so smooths all unevenness on the surface of the bushing that there is no seizing and "bugging up" when the bush is pushed home in the machine frame. This was a common source of annoyance and loss when the outsides of the bushings were ground.

I was told that the saving in time for the manufacturing end was between 25 and 30 per cent over the old way and that in assembling, taking into consideration the trouble with bugged-up bushings, a similar amount of time was saved. There was absolutely no comparison possible between the ground and the broached bushings so far as quality of work was concerned. The latter have the further advantage that the compressed surface wears much better than the reamed.

One little trick worthy of mention in that English factory is that the hard bronze played the dickens with the steel tools which had to be ground after every half dozen or so bushings were turned. The cut was very shallow, not more than ½ in., but much time was lost in resetting to depth. Various expedients were tried in the way of setting gages and grinding attachments secured to the lathes so that the tool could be ground without releasing it from the toolpost but the trouble was finally solved by the use of black diamond (carbon) tools. These would hold their size for weeks at a time and when too dull to cut properly they were easily resharpened on a diamond cutter's wheel. I was told by the management that the saving in grinding time, for steel tools whose life would be equivalent to the life of a diamond tool between resharpenings, more than paid for a new diamond tool.

The use of the diamond tools was comparatively new to them and at first they were used for turning only; however, while I was there they were experimenting on diamond boring tools and had obtained some fairly good results.

Magnetic Chucks

Ellsworth Sheldon
ASSOCIATE EDITOR AMERICAN MACHINIST

V. The Blanchard Chuck

Magnetic Chuck Necessary Part of Grinding Machine—Blanchard Chuck Made from Solid Steel Block—Unique Construction Methods Used

AN INTERESTING example of the magnetic chuck is that developed by the Blanchard Machine Co., Cambridge, Mass., as a part of their well-known surface-grinding machines. Being unhampered by the limitations that are imposed upon designers of tools intended for general utility, and having in mind only the serviceability of the device as a part of their machine the engineers of the Blanchard company were able to devote their attention to the production of a chuck that would at once provide maximum holding power and afford the greatest resistance to hard work and possible abuse without impairment of its accuracy or disarrangement of its electrical components. The makers of this device consider it as the work table of the machine and it is used in that capacity whether its magnetic properties are called into service or not. Provision is made for bolting work to it so that it may be used to hold pieces of non-magnetic material as well as iron or steel. Fixtures are designed to bolt to the table for the purpose of holding non-magnetic material or pieces that are of very irregular shape.

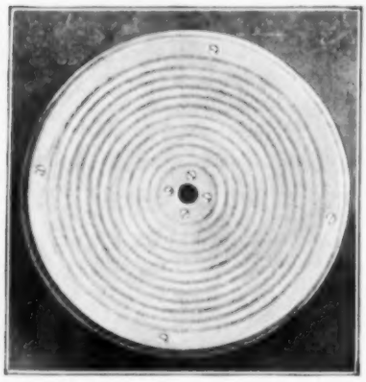


FIG. 72. UPPER SURFACE OF BLANCHARD CHUCK

Though magnetic chucks had been on the market for nearly twenty years when the Blanchard chuck was patented (Jan. 19, 1915), they had been generally considered an adjunct of the surface-grinding machine as used in toolrooms and classed as a toolmaker's device. Surface grinding as a manufacturing proposition was still in its experimental stages; indeed the Blanchard high-powered vertical-surface grinder may be considered as one of the pioneers in this field.

The successful development of the rotary grinding machine was almost dependent upon the magnetic chuck; without this quick, simple and sure method of clamping work upon the table, with its absolute freedom from interfering accessory parts, the introduction of the process of production grinding upon a multitude of small parts would have received a serious setback if it had not been entirely prevented. Even now it is necessary only to contemplate what would happen to a table full of small irregular-shaped and insecurely-held pieces of cast iron or steel if even one of the forest of small bolts and clamps, that but for the magnetic chuck would be necessary to hold the work, should let go under the pressure of the grinding wheel, to conceive the difficulties against which the sponsors of such a method would have to contend.

Blanchard Makes Chucks Only for Blanchard Grinding Machines

The Blanchard Machine Co. makes chucks only for its own machines, and consequently only in the round form. Three sizes are made: 16 in., 26 in. and 30 in. in diameter. There are differences other than size between them but the difference is because of physical limitations and does not materially change the method of manufacture or alter the electrical characteristics.

In Fig. 72 may be seen a top view of the Blanchard

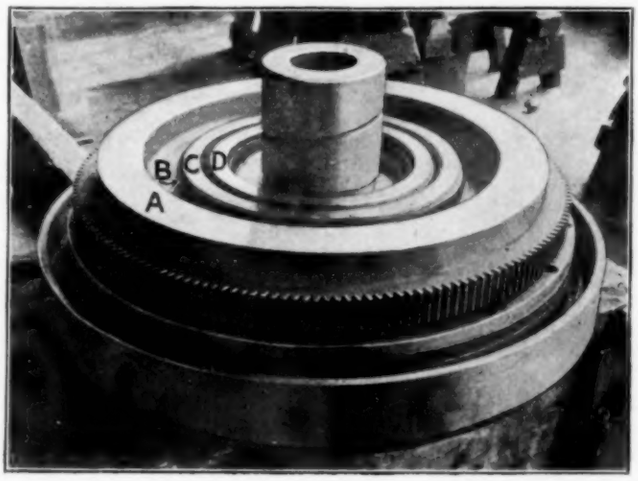


FIG. 73. CHUCK INVERTED TO SHOW MOUNTING

chuck displaying the characteristic circular zones of magnetic influence separated by unbroken dividing rings of brass, which distinguish this chuck from all others now on the market. Fig. 73 shows the reverse

side of the chuck with the bearing and driving ring upon which it is mounted.

Unlike other grinding machines of its class, the Blanchard has no spindle other than the one which carries the grinding wheel. Thus the chuck as seen in Fig. 73 is a complete machine table ready to take its place in the machine. The hollow stud in the center is the journal of the bearing in which the chuck turns, while the carefully scraped bearing surface *A* supports the weight of the chuck and work and takes the thrust of the grinding operation. Upon the periphery of this casting, which is nearly as large in diameter as the chuck itself, are the gear teeth that mesh with the driving pinion.

The Contact, or Collector Rings

A ring of bakelite, to be seen at *B*, is located concentrically upon the casting and fastened to it by fillister-head screws. Upon this insulating ring, the bronze contact rings *C* and *D*, constituting the means of electrical communication betwen the stationary machine frame and the revolving table, are mounted. The

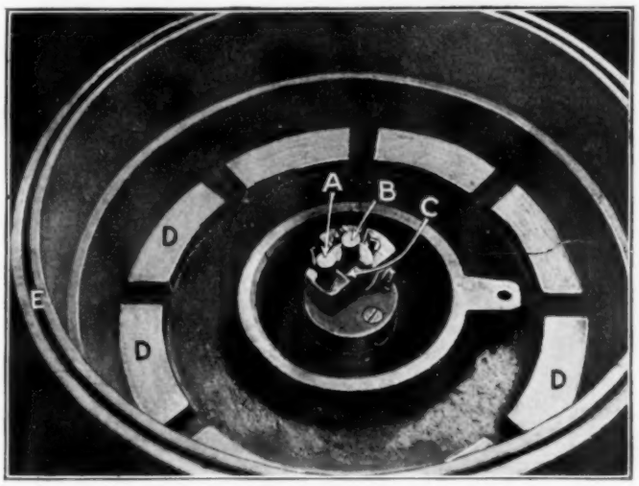


FIG. 74. BRUSHES IN PLACE ON GRINDING MACHINE, CHUCK REMOVED

construction of the smaller grinding machine is somewhat different in the manner of mounting and driving the chuck but the principles are the same.

In Fig. 74 is shown one of the smaller machines with the chuck removed. The brushes *A* and *B*, which carry the electric current to the contact rings, are round plugs of carbon resting upon coil springs contained within the bakelite mounting block *C* so that the electric contact is established under spring pressure and remains constant in despite of wear or changing conditions due to changes in temperature.

The bakelite block, or brush-holder, of the smaller machine is so placed inside the hollow central stud as to establish electrical contact with the chuck as nearly as possible to the center of its rotation. The brush *B* is at the exact center and there is no movement between it and the contact ring (which in this case is a button) except a rotative one; while the diameter of the ring in contact with brush *A* is not more than three inches; thus the wear upon the brushes is reduced to a minimum. The brushes for the 26-in. chuck are mounted outside the central stud and the contact rings are necessarily larger.

Front and back views of the insulating ring used on the larger chucks are shown respectively at *A* and *B*, Fig. 75, and at *C* is the corresponding part for the 16-in. size. The brush-holder and brushes are shown at *D* in the same illustration, while at *E* may

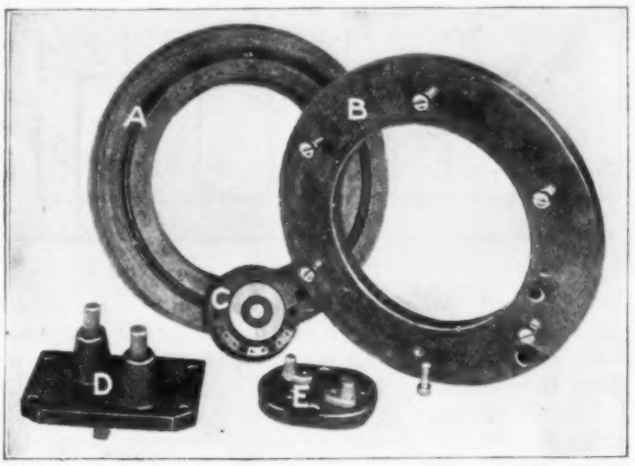


FIG. 75. CONTACT RINGS AND BRUSHES FOR CHUCKS

be seen the terminal block used on the 26-in. chuck to establish electrical connection between the contact rings and the wires of the coils.

Referring again to Fig. 74, *D* is the surface upon which the ring *A* in Fig. 73 bears. Both these surfaces are carefully scraped to the special surface plate shown in Fig. 76, which is made in the form of a ring. The surface *D*, Fig. 74, instead of being a continuous ring, is interrupted at intervals to facilitate lubrication.

Blanchard Chucks Made of Steel Forgings

The limitation in the matter of weight, which must ever be kept in mind by the designer of accessories, could be ignored by the Blanchard engineers for the reason that they were designing a machine table rather than a chuck. Instead of being built up from steel castings, the Blanchard chuck is "dug out" from a solid disk of forged steel weighing, in the 26-in. size, approximately 600 pounds. By using a forging the designers avoided trouble consequent upon the lack of homogeneity and the presence of blowholes that is characteristic of steel castings and which might result in leaks both of water and of magnetism; the first because of holes penetrating the structure and the second because of interruption of the magnetic currents where no interruption should exist. A section of the 26-in. chuck is shown in Fig. 77 and in Fig. 78 may be seen one of the blanks on a Bullard vertical turret lathe where the "digging out" is in progress. The grooves *A* (Fig. 77) are cut one at a time, two cuts to each groove, with a tool slightly less than half the width of the groove. This leaves a central wall while the second cut is being made that holds the tool against a tendency to "crawl" away from its work as would be the case were it cutting on

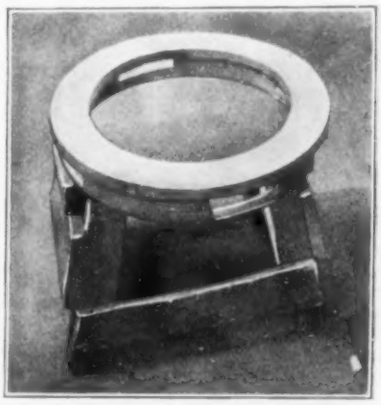


FIG. 76. SURFACE PLATE USED WHEN SCRAPING THE THRUST BEARINGS

one side only. The wall is easily broken out after both cuts are down to the required depth.

No attempt is made to secure a smooth surface on these cuts beyond that which results from keeping the

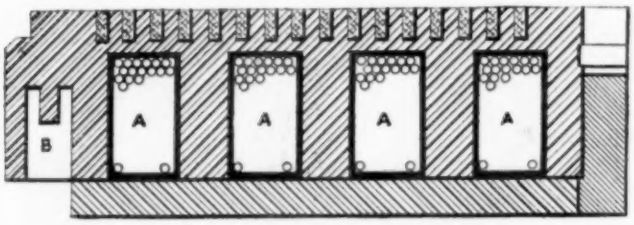


FIG. 77. SECTIONAL VIEW OF BLANCHARD CHUCK

tool properly ground for its work. The slight roughness gives a better hold to the insulating compound with which all otherwise vacant spaces in the chuck are filled before closing it up.

The chuck body shown on the table of the vertical lathe in Fig. 78 is nearing completion, so far as this operation is concerned. The outer grooves have already been cut, but as the tool works under a flood of cutting compound, the finished grooves are filled with the liquid and do not show to advantage in the picture.

The cutting is done at comparatively high speeds with strong feeds, and taxes the capacity of the machine and tools to the utmost. The broad surface of the cutting tool causes chatter despite the deep cross-section and the short distance the cutting portion projects from the holder. Though the cross-rail is brought as low as possible it is still necessary to provide additional support as nearly as may be in the direct line of thrust, and for that purpose a bar of steel suitably shaped is introduced between the toolholder and the saddle of the machine, being held by the C-clamp shown in the picture. The chatter is thus very much reduced but it is far from being eliminated.

Cutting the Small Grooves

The smaller grooves on the upper surface of the chuck, 15 in number on the 26-in. size, are cut with a gang tool holding 5 blades. These small grooves are for the purpose of breaking up or interrupting the flow of magnetic current and compelling the lines of force to pass through the work. Were it not for these grooves the current would find an easy path through the chuck body and would exert no holding power at the surface.

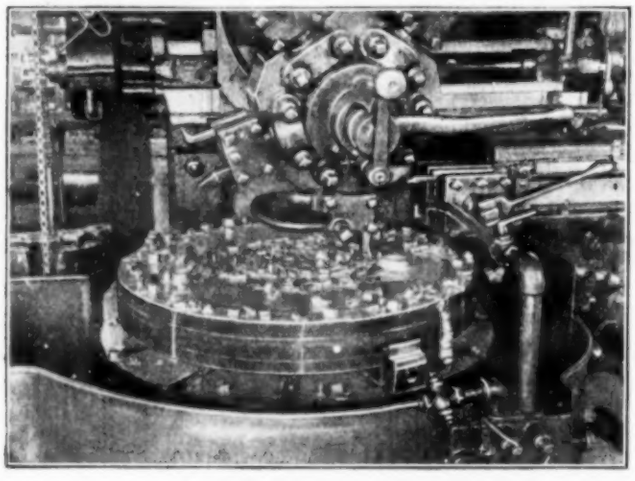


FIG. 78. "DIGGING OUT" A BLANK FOR 26-IN. CHUCK

As was explained in the introductory article, these grooves but partially interrupt the magnetic currents. There is an unbroken section of steel ⅛ in. thick below the grooves in which the degree of magnetic "saturation" must approach the practical limit before the full value of the magnetizing influence is available at the surface.

In designing this chuck the engineers were obliged to choose between two evils: One being to make a composite chuck surface, that, however tight it might be when new, was open to the possibility of developing a leak after months of hard service and perhaps abuse; the other to make a chuck that should have no joints whatever in its upper surface, but that would, because of this condition, require a higher energizing current. Knowing that the chuck would be required to work

FIG. 79. BRASS DIVIDING RINGS AND TOOLS FOR STAKING THEM

continuously under a flood of strong alkaline solution that quickly would cut its way through the protective covering of the coils if allowed to reach it, they chose the latter alternative.

Knowing the area of the cross-section of material through which the magnetic currents would have uninterrupted flow, and knowing from the permeability chart the amount of current required to saturate that section, the engineers had only to provide the requisite number of ampere turns to bring about this condition and then build up from that point by adding a sufficient number of turns to produce the density of magnetic flux in the remaining parts that would insure satisfactory holding power at the surface of the chuck.

For this reason the energizing current required by the Blanchard chuck is somewhat in excess of the demands of other chucks; to offset which insignificant disadvantage there is a chuck body made of a single

piece of homogeneous material through which water cannot possibly penetrate.

Electrically, or rather magnetically, considered, the object sought in breaking up the surface of the chuck is attained in the cutting of the grooves. The chuck would be just as strong mechanically and as powerful magnetically if these grooves were left open, but in this condition they would become a settling basin for iron chips and sediment until the magnetic conductivity was at least partially restored, and the chuck would lose its grip to a corresponding degree. To prevent this condition as well as to present a smooth unbroken surface to the work these grooves are filled with brass.

The manner of setting in these brass rings is ingenious. Strips of sheet brass one or two thousandths thinner than the width of the grooves are cut and formed on a bending roll to circles of approximately the same diameters as the grooves. The ends are neatly butted together to make a complete circle.

The width of the brass strips is such that when they are driven into the grooves, the driving being accomplished by means of a mallet, the brass will project about $\frac{1}{32}$ in. above the surface of the steel. The chuck is then trued up on the table of an old boring mill in the tool bar of which is a pneumatic hammer fitted with a staking tool.

By means of the saddle and slide-rest, the staking tool is brought down on one of the brass rings, the mill table started and the air turned on the hammer. About two turns of the table to each ring is sufficient to spread or swage the metal so that it completely fills the grooves, closes all joints, and shows an apparently unbroken ring of brass.

Not a very good way to treat a boring mill? Perhaps not, but the mill in question is an old one that has been superseded in production work by a modern tool of the same class. It does neatly and quickly a job that would otherwise require a great deal of time, not to mention patience and back-breaking work; therefore it is earning its keep as surely as if it were cutting metal. Besides all this, the mill is as capable of "taking off the first cut" as it ever was.

After staking in the rings, the chuck is transferred to the vertical turret lathe and faced off flat, no attention being paid to fine finish, for all chucks are ground in place on the machine with which they are shipped. At the same setting the outside is finished and the center hole bored.

At the time of the writer's visit to the Blanchard plant, no staking was being done, but in Fig. 79 may be seen the mill, the hammer and a pile of brass rings ready for the next batch of chucks to come along.

As may be seen in Fig. 77, a groove *B* is cut at a point that is really outside the body of the finished chuck, to prevent water from getting to the only place where it would find a possible entrance to the interior.

The chuck body could not well be more completely water-tight than it is. There are no holes or openings of any kind communicating with or leading from the

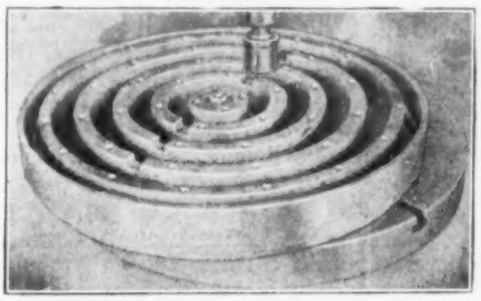


FIG. 80. A 26-IN. CHUCK INVERTED: MACHINE WORK FINISHED

upper surfaces; none have ever been made. The coils of wire practically fill the space which they occupy; and to make assurance doubly sure the last operation before closing the chuck is to fill these spaces with a molten insulating compound which is hot enough to penetrate any minute space that may be left. The joint between the chuck body and the cover plate (which is on the bottom of the chuck instead of the top) is ground, and is therefore water-tight.

Not Much Chance for Leakage

Notwithstanding all these precautions against leakage to a point where the coils might be injured, the stop-water or "skirt" sets over a ring shown at *E*, Fig. 74, that is part of the machine frame casting and excludes water from any place where it could find entrance to the chuck if such entrance existed. The annular groove in this ring is provided with drain holes leading to the under-side of the machine frame so that if water could get by the first guard it could not fill the groove, and thus would not have a chance to pass the second.

A chuck body on which practically all machining has been done is shown in Fig. 80 on the table of a drill-press where it is being tapped for the screws that hold the cover plate. The four grooves for the coils are plainly shown, as is also the stop-water groove. The rectangular slot milled across the main divisions is to accommodate the cross-connections between the coils and before closing the chuck this groove will be filled with the insulating compound.

The cover plates are plain disks of steel ground on both sides, and having no holes that communicate with the interior of the chuck except the one that receives the terminal plate previously mentioned; which, when the chuck is finished, is sealed in with a special water-and-oil-proof insulating compound.

(Continued in next week's issue.)

Gears for Motor Transmissions

Machining Operations—Construction of an Unusual Gear Chuck—Finish Grinding the Sides of the Teeth on Spur Gears—Assembly of Gear Sets

By FRED H. COLVIN
Editor, *American Machinist*

BEGINNING with the countershaft drive gear which has 31 teeth of $\frac{8}{9}$ pitch (Fellow's stub tooth) and is in consequence a little less than 5½ in. outside diameter, the first machining operation is to bore and face the first side. This work is done on a double-spindle Jones & Lamson machine in the usual manner, as in Fig. 1. Next comes the reversal of the piece and the turning and facing of the second side. The sides are then ground on the vertical spindle machine shown in Fig. 2, after which the hole is reamed, and the teeth are blocked out on a Barber-Coleman hobbing machine.

Finishing the teeth is done on a Fellow's gear shaper after which there is a small filing operation to remove burrs, after which the gear goes to a special rolling device mounted on the lathe carriage, as shown in Fig. 3. The gear *A* to be rolled is mounted on a suitable mandrel and run in mesh with the hardened gear *B* so as to bring out the bearing surface. This method has been very successful in maintaining a high quality of gears, because should they not show up well on this test, steps are immediately taken to find out the cause.

Every operation is inspected and there is a final inspection before going to the hardening department. The gear is then carbonized, brushed, re-heated, quenched and drawn to the proper temperature, after which it is brushed again and sand-blasted. It is then polished for Brinell testing, though the old-fashioned file test is still used, as is the case in so many other manufacturing plants.

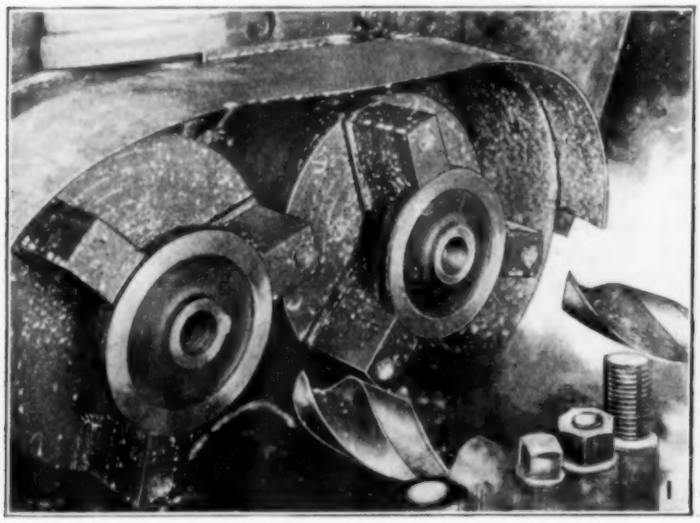


FIG. 1. BORING IN DOUBLE SPINDLE FLAT TURRET MACHINE

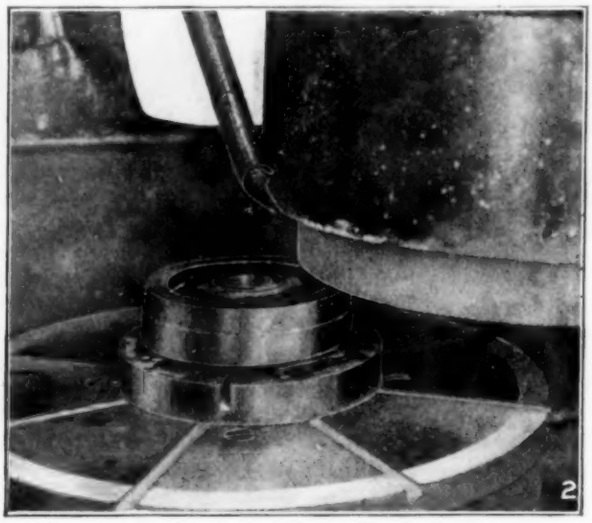


FIG. 2. GRINDING THE SIDES

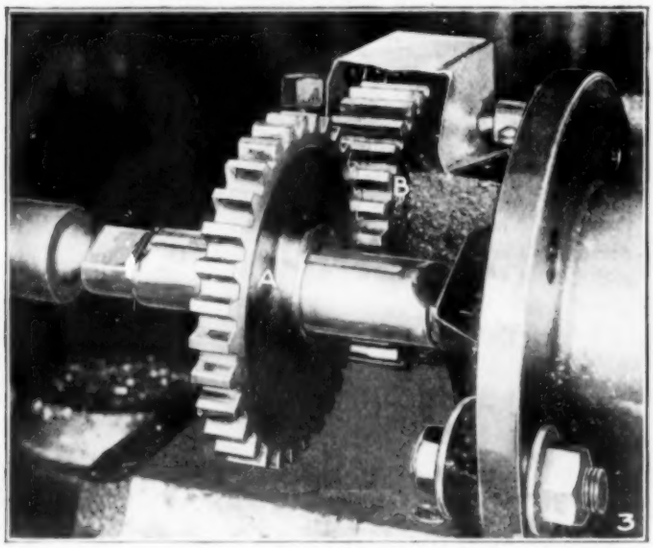


FIG. 3. ROLLING THE GEARS

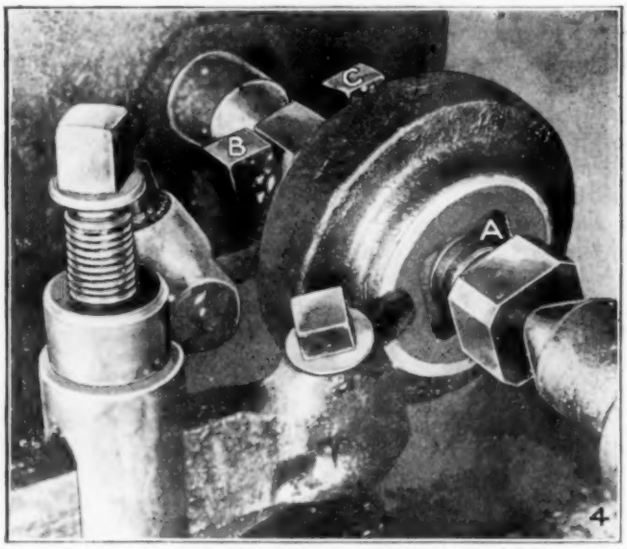


FIG. 4. STRADDLE FACING THE SIDES

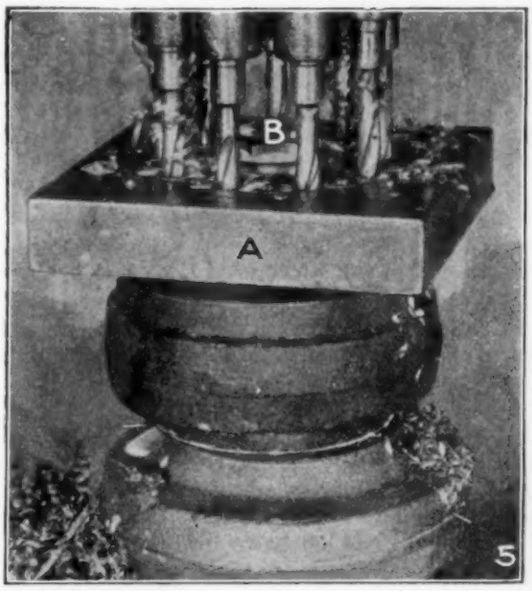


FIG. 5. DRILLING FOR CLUTCH

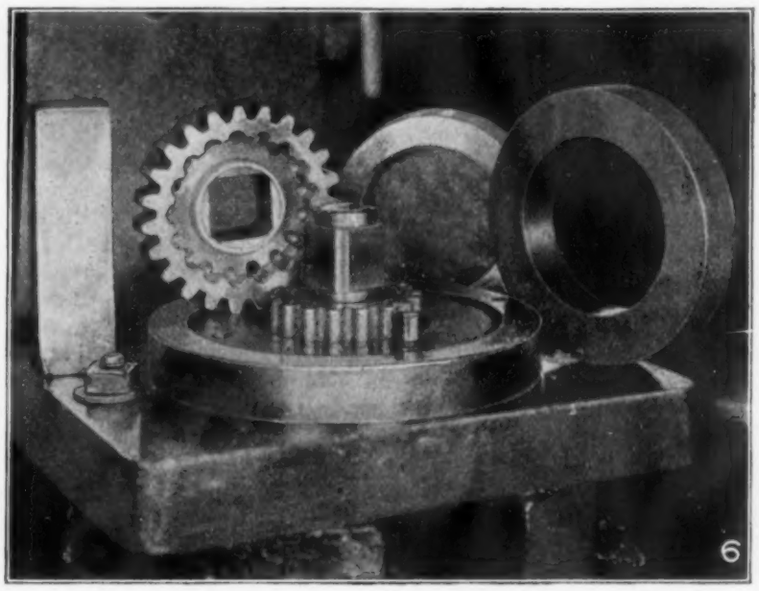


FIG. 6. SHAVING THE TEETH IN CLUTCH PIECE

The hole is then finish-ground on a Heald internal grinding machine after which the gear goes to final inspection and assembly.

The small sliding gear slides on a square shaft so that the first operation is to drill and broach the hole as a means of centering, and also of driving, for all future operations. It is then mounted on a square mandrel *A*, Fig. 4, which runs between the lathe centers and is driven by the forked dog shown at *B* and *C*. Both sides are faced by straddle tools in the toolpost after which the hole is chamfered as a bench operation.

As one side of this gear forms the internal member of a toothed clutch, it is necessary to drill holes something over half way through the blank, this being done in the simple fixture shown in Fig. 5. Here a multiple-spindle drill takes care of this operation; drilling alternate holes. By then turning the gear blank a single space the remaining holes are drilled with the same set-up. It will be noted that this fixture consists simply of the plate *A* carrying a hardened steel bushing and that it is held in contact with the gear being drilled by the nut *B* acting on a central stud fastened to the drilling machine table. Three of the holes are drilled through the gear as can be seen in Fig. 6.

The gear teeth are then blocked out on a hobbing machine and shaped to size after which they are pointed as will be seen in a later illustration. Corners are then filed and the teeth rolled as shown before in Fig. 3. Final inspection before hardening comes next, after which the same hardening processes, as before mentioned, are gone through with, including the testing of the teeth with a file.

The square hole is next ground with the interesting device shown in Fig. 7. The gear is mounted in the

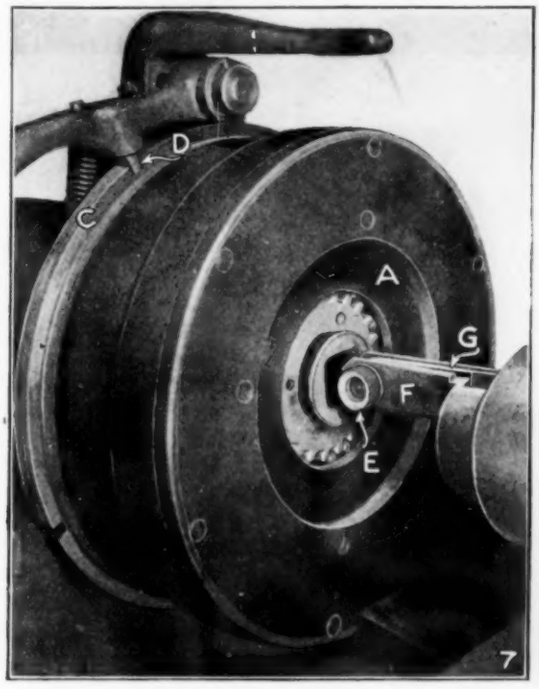


FIG. 7. GRINDING A SQUARE HOLE

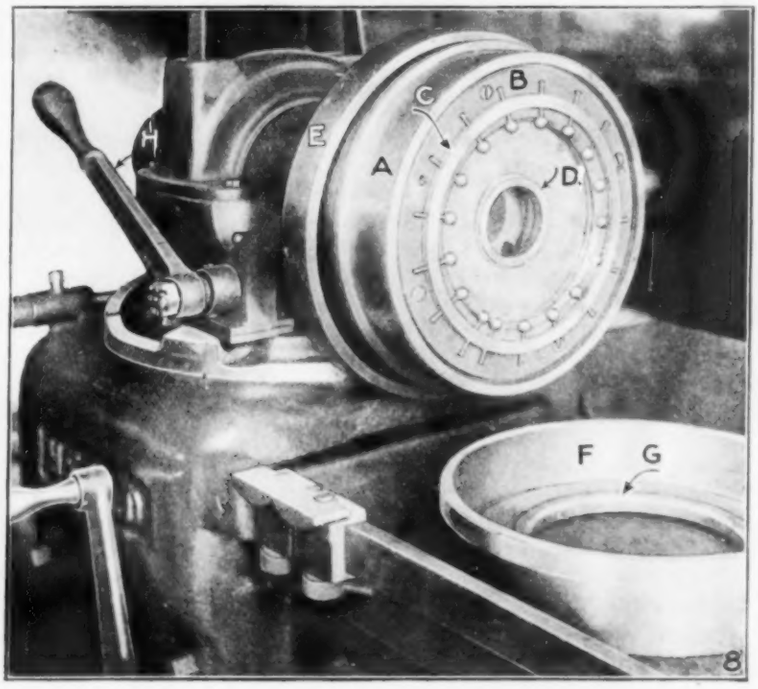


FIG. 8. DETAILS OF THE GEAR HOLDING CHUCK

special chuck shown at *A*, the gear being centered by means of the steel balls shown. It is indexed by the notches in the large ring *C* and the index pin *D*. The grinding is done by the small cup-wheel *E* mounted on a spindle in the end of the projecting arm *F* and is driven by an endless fabric belt at *G*. The grinding wheel is of the proper diameter to give the desired flat surface as it is traversed through the hole. This method insures the sides of the hole being concentric with the average pitch line of the gear, the ball chuck used being designed especially to give the best result possible in taking care of the small distortions of the hardening process. After grinding, the flange is polished and the gear is ready for assembling.

Before taking up the operations on the next gear it may be interesting to see the construction of the chuck shown in Fig. 7. Fig. 8 shows one of these chucks with the outer ring removed so that its construction can be clearly seen. The body of the chuck *A* carries the ring *B* on which is mounted another ring *C* carrying the numerous balls shown for holding the gear. These balls are mounted on steel stems with collars at the outer end to hold the springs which tend to keep them drawn up against the ring *C*. It will be noted that the inner edge of the ring *C* is beveled and that the larger diameter of the balls rests on this beveled surface. Furthermore, the surface *D* is ground square with the spindle of the machine forming a true surface against which the side of the gear to be ground can be located.

The large outer ring *E* is threaded on the inside to receive the outer portion of the chuck *F*. This portion also has a beveled surface at *G* corresponding to the inner beveled surface of the ring *C*, so that when it is screwed into ring *E* the beveled surface *G* comes in contact with the outside of the balls. The ring *E* is connected with the lever *H* by means of a suitable linkage so that it can move longitudinally with the spindle and move the ring *F* with it.

With the outer portions *E* and *F* moved forward, the operator inserts the gear in the chuck until it comes against the face *D*, the balls in the meantime finding their places in between the gear teeth. Drawing back the outer portions of the chuck *E* and *F* brings the beveled surfaces in contact with the balls and forces them all toward the center, gripping the gear on the pitch line at many points. It is, of course, necessary to have a chuck of this kind for each size of gear but when thousands of gears are being ground the cost is distributed so that it becomes almost negligible, while the results which have been secured make it an economical device from every point of view.

This is the gear that matches into the sliding gear which has just been described. After the inspection of the forging the gear end is centered and rough-turned. It is then chucked by the gear end and the stem finish-turned and threaded and the back of the gear finished. The next move is to hold the stem in a collet and finish-turn the gear and bore the taper in the end. The spline is then cut in a Pratt & Whitney machine, the hole for the cotter pin drilled and the stem rough-ground to 0.005 in. oversize.

Using the rough-ground stem to chuck by, the gear goes to the gear shaper in Fig. 9 and the teeth are cut as shown. The ends of the teeth are next rounded as shown in Fig. 10, the stem of the gear slipping inside the chuck and being held by a setscrew at *A*. The pin *B* provides additional resistance against turning. The method of rounding the teeth is simple and yet very effective, the main feature being the substantial supporting spindle which reduces chatter and vibration to a minimum. The outsides of two teeth are rounded at the same time, being of course equivalent to completing a tooth with each advance of the cutter *C*. The gear is rotated by a rapidly operated index, lubricant being supplied by a brush.

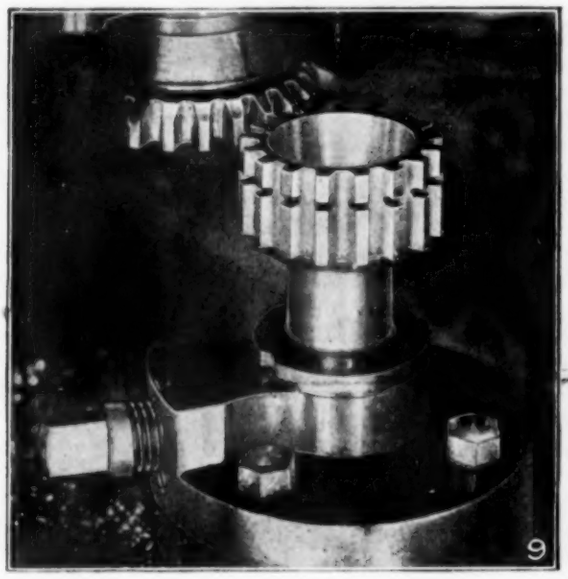


FIG. 9. SHAPING THE TEETH

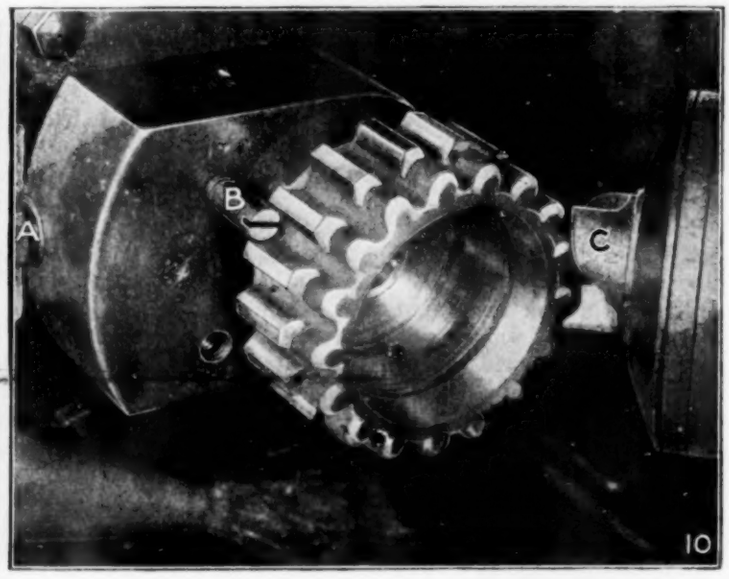


FIG. 10. ROUNDING TOOTH CORNERS

The groove cut around the gear end is for the purpose of making a clearance for the second tool in cutting the rounded teeth on the part which forms the male clutch member. Fig. 11 shows the use of double cutters on a Fellows gear shaper, these cutters being of different contour as can be seen. The first cutter finishes the teeth of the gear while the second cutter gives the rounded tooth form which makes the outer end portion into a clutch. The stem of the gear is held in the same kind of a chuck, as shown in Fig. 9.

The stem gear is now ready for the usual inspection and hardening.

One of the most interesting operations which has been

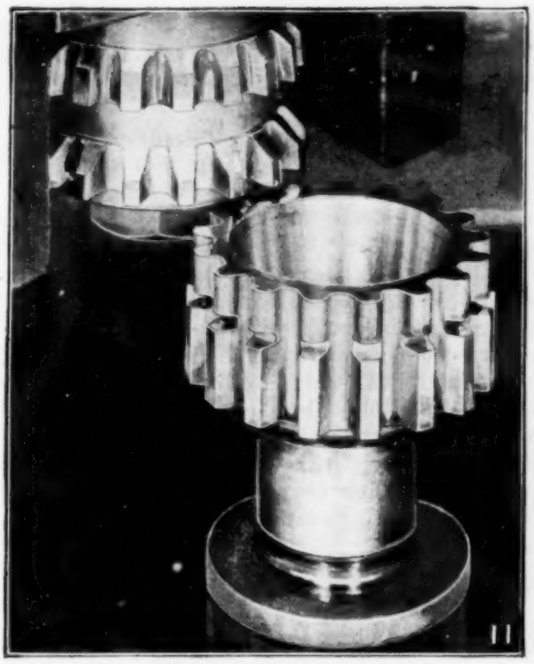


FIG. 11. CUTTING TWO FORMS OF TEETH AT ONCE

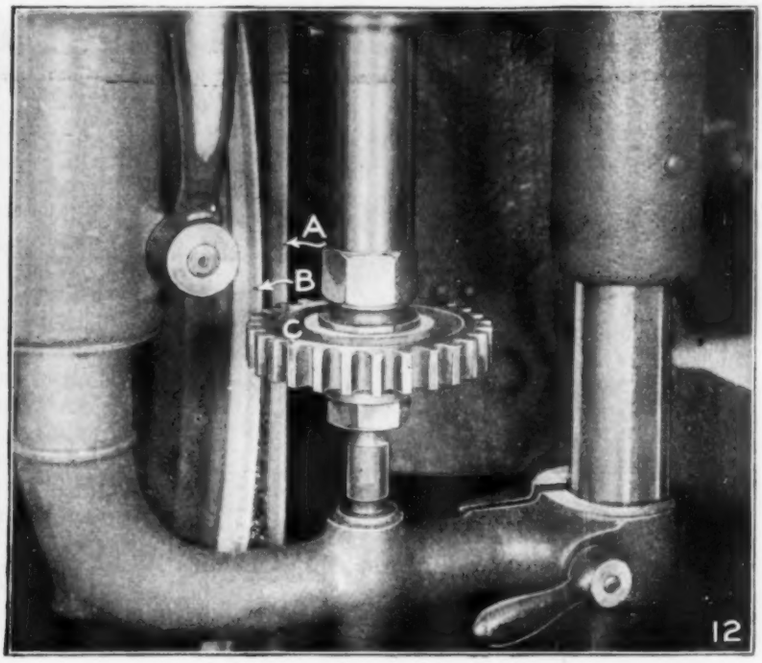


FIG. 12. CORRECTING TEETH AFTER HARDENING

developed in this factory is the method of finish-grinding the sides of the teeth on the spur gears used in the transmission. This operation is shown in Fig. 12, which, however, shows only a small portion of the special machine. This process is one of generating, in which the two grinding wheels *A* and *B* form the sides of a rack, the gear *C* being rolled past this rack so that its sides generate the tooth curve and so correct any small irregularities which might develop in the hardening process.

The grinding disks are approximately 6 ft. in diameter and are composed of thin segments of abrasive material suitably fastened to steel disks and their faces dressed to form the sides of a rack tooth. As in the case of the tooth rounding cutter, the wheels do not act on both sides of the same tooth at the same time, but are of course equivalent, in production, to grinding both sides at one operation. This is a most interesting machine in many ways.

Figs. 13 and 14 show two gear assembling operations which go to make up the complete gear sets for the transmission. Fig. 13 shows the assembling of the first and second gears on an arbor press. The assembling of the gears is guided by the pin *A*, suitable keys being inserted in the other keyways which can be seen in both of the larger gears.

In Fig. 14 the two center sliding gears are being assembled on a Lucas press which both forces them together and upsets the rivets as shown at the right. The gears rest on the block *A* and are forced down by the rings *B* and *C*. This makes a simple combination which has worked out very satisfactorily.

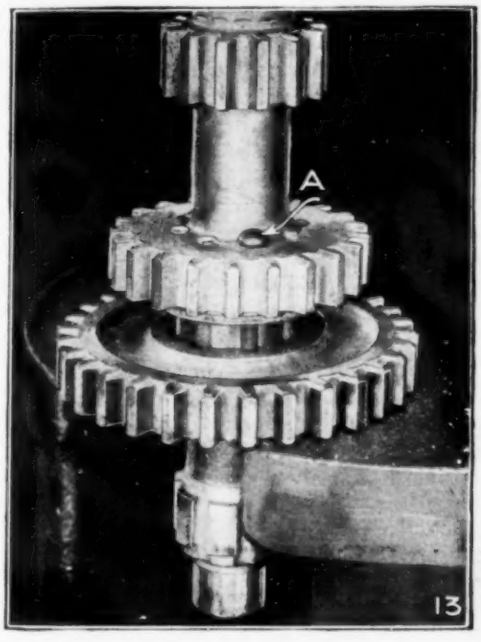


FIG. 13. ASSEMBLING FIRST AND SECOND GEARS

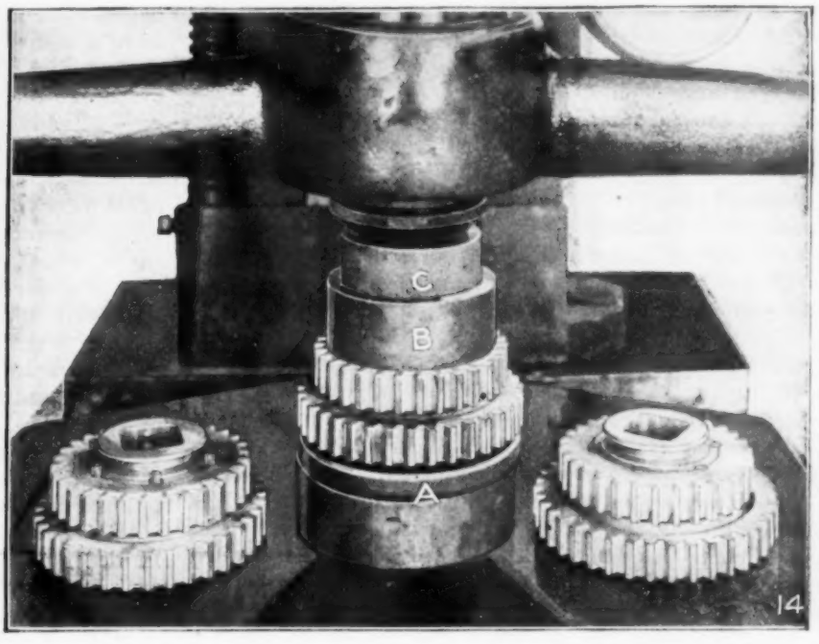


FIG. 14. ASSEMBLING THE TWO CENTER GEARS

Metal Cutting Tools—VII

By A. L. DeLeeuw

(Continued from last week's issue.)

THE fluctuations in pressure may be extreme and cause severe hammering. To overcome this effect cutters are made with spiral teeth, whenever practical. To study the effect of making the teeth spiral around the body, we will imagine that only one tooth is at work. This tooth is shown in Fig. 118. It is represented as made up of a number of very narrow sections.

In Fig. 118 is shown these imaginary sections of the tooth, and Fig. 119 shows some of them at work in the section of metal about to be removed. Fig. 119 shows clearly that while one section is just about to begin

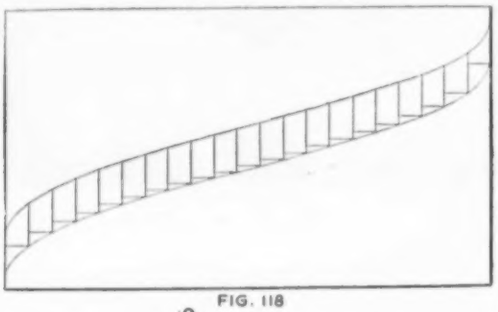


FIG. 118

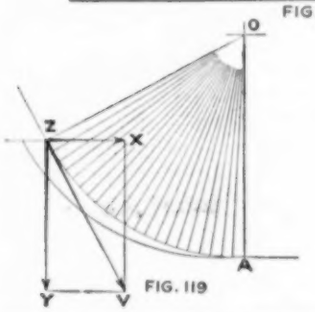


FIG. 119

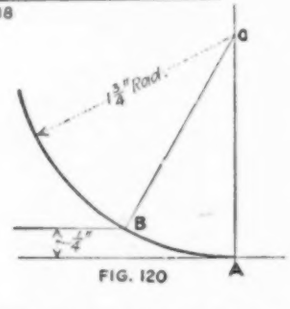


FIG. 120

FIG. 118. IMAGINARY SECTIONS OF SINGLE SPIRAL TOOTH.
FIG. 119. ACTION OF SPIRAL TOOTH SECTIONS.
FIG. 120. DIAGRAM TO SHOW EFFECT OF SPIRALITY ON PRESSURES

the cut and would have a tendency to slide over the metal, other sections are in the cut. Take the last sections engaged—*OZ*—and it will be readily seen that the resistance is in the direction *ZV*. This resistance causes a pressure in the direction *ZX*, which is overcome by the feed pressure and a pressure *ZY*, which has a tendency to pull cutter and arbor downward. This downward pressure is in direct opposition to the upward pressure, due to the inability of section *OA* to penetrate into the metal. To visualize still better how the spirality of the tooth affects the upward and downward pressures and their fluctuations, we will take a concrete example.

We will take a cutter 3½ in. in diameter with one tooth, making a spiral of 25 deg. with the axis. We will further assume that the piece of work is 5 in. wide and that the cut is ¼ in. deep. A single point of the cutter strikes the work at *A*, Fig. 120. At that moment an upward pressure is started, which, however, is infinitesimal, as only one point of the cutter strikes the work. As the cutter rotates, more and more elements come in contact with the work and the upward pressure caused by each element becomes greater and greater as the element slides further over the work. This upward pressure is shown in Diagram 121. We will assume that the cutter slides over the work until it is lifted 0.001 in., when it begins to penetrate. A simple calculation will show that the cutter has traveled through an angle of 1 deg. 56 min. when this happens. The lead of the spiral is $D\pi \times \cot g$ angle of spiral: in this case $3\frac{1}{2} \times \pi \times \cot g$ 25 deg. = 22.5533 in. This is the length the cutter would have to have if the spiral were to go once completely around the body. That portion of the spiral (tooth) which has not yet penetrated, goes around the body only through an angle of 1 deg. 56 min., so that only a small fraction of the spiral tooth is in action when it is about to start cutting (that is, when the sliding over the work is at an end and the tooth begins to penetrate). This fraction is $\frac{1^\circ 56'}{360} = \frac{116}{21600}$. The length of tooth in action is therefore $\frac{116}{21600} \times 22.5533$ in. = 0.121 in. This shows that when less than ⅛ in. length of tooth has started work, penetration begins. From that moment on this element of the cutter causes a downward pressure, at first very small, but gradually increasing as it goes deeper into the metal. Of course the next element is still sliding and the downward pressure of element No. 1 does not yet completely counteract the upward pressure of element No. 2, etc. It does show, however, that the curve will have the general shape of Diagram 121; upward pressure acceleratingly increasing for a certain period (for a length of cutter of 0.121 in.), then diminishingly increasing from *B* to *C*. At this point *C* the downward pressure caused by element No. 1 is greater than the additional upward pressure caused by the latest element coming into action and from that moment on, the upward pressure is no longer increased, while the downward pressure is, so that finally the upward pressure is completely counterbalanced (at point *D*). If a still greater part of the tooth comes into action before element No. 1 is entirely out of the cut, the downward pressure will predominate and the diagram will go on to point *E*. If the work is still wider, an element of the cutter will get out of the work while another gets in, and conditions will remain stationary (from *E* to *F*). Finally elements of the cutter will leave the work while no new element will enter. The upward pressures will therefore diminish while the downward pressures may either diminish also or remain stationary for a while, or even increase temporarily; but finally they will decrease as one element after another leaves the work until at least the entire tooth has left the work and the pressures vanish. The three possibilities are shown by the three curves between *F* and *G*.

The diagram shows that there are no sudden changes of conditions or violent fluctuations, except when the work is so narrow that the part *EF* does not come into play. However, there is still a changing over from upward to downward pressures.

We will now see what the effect is of additional teeth. In order to see clearly what happens, we will represent Diagram 121 in a little simpler form and forget, for the present, some of the details.

If the second tooth enters the work after the first

For the author's forthcoming book. All rights reserved.

tooth has reached *G*, there will be the modification of Diagram 122. If it enters somewhere between *F* and *G*, upward pressure will be added and the diagram will be like Fig. 123.

If the second tooth enters somewhere between *E* and *F*, the diagram will appear somewhat like Fig. 124.

The exact manner in which the diagram will be modified cannot be predicted, but this much will be seen: That the second tooth *may* make the diagram more abrupt in its changes, but that, as a rule, it will make the changes less abrupt and the fluctuations will be still gentler if more than two teeth are at work at the same time.

We will now consider the practical side of the foregoing. We will first take our example of a piece of work 5 in. wide. The cut is ¼ in. deep. A simple calculation shows that a single element of one tooth stays in the work during 31 deg. When the first element of the tooth is about to leave the work, $\frac{31}{360}$ of the circumference is engaged, so that this one tooth covers a width of $\frac{31}{360} \times 22.5533$ in. $= 1.94$ in.

Let us suppose that the cutter has eight teeth. Then the first element of the first tooth must rotate through 45 deg. before the first element of the second tooth enters. The length of tooth brought into play during these 45 deg. is $\frac{45}{360} \times 22.5533$ in. $= 2.82$ in. The second tooth enters now and two teeth will be in action until the last element of the first tooth leaves the work (see Fig. 125). The result will be this:

0 to 1.94 in.—changing conditions
1.94 to 282 in.—stationary conditions
} one tooth at work

2.82 to (2.82 + 1.94) = 4.76 in.—changing conditions
4.76 to 5—stationary conditions
} two teeth at work

A wider or narrower piece of work, a deeper or shallower cut, a different diameter of cutter and a greater or lesser angle of spiral would modify the figures given. To get the least possible variations in pressure the cutter should be large; the angle of spiral large, the cut deep, the work wide and the teeth close together. The only elements within our control are the diameter of the cutter, the angle of spiral and the spacing of the teeth. If nothing else but the fluctuation of pressure had to be considered, we would select a large cutter, a large spiral angle and fine spacing of the teeth. We will see later that other considerations compel us to make the spacing wide, in most cases; that we should select the smallest cutter possible under given conditions and that, though we should make the angle of spiral large, yet even there we are limited in our choice.

Causes of Chatter

In the discussion of lathe tools, mention was made of the tendency of a broad-nosed tool to cause chatter. The sections of metal would be split off at regular intervals, quite close together, and this would cause vibrations. If the natural period of vibration of one of the machine elements happened to coincide with the periodical splitting off of the chips, these vibrations would become of considerable magnitude. Making the tool round-nosed would destroy the regularity of the splitting off of sections of metal, at least to a certain extent, and chatter would not be so likely to occur.

Chatter is much more in evidence in a milling machine than in a lathe, and this is due to the peculiar way in which the cut is taken. In a lathe the tool remains imbedded between work and chip and the fluctuations in pressure are due to compression and splitting off of the individual sections of the chip. This same thing happens when a tooth of a milling cutter forms a chip. The fluctuations, however, are not uniform but change continually while the tooth is in the work. As soon as another tooth starts work, a similar cycle is begun and this is repeated for every tooth brought into action. If, for instance, the teeth of the cutter are spaced 1 in. apart and a cut is taken at a speed of 70 ft. per

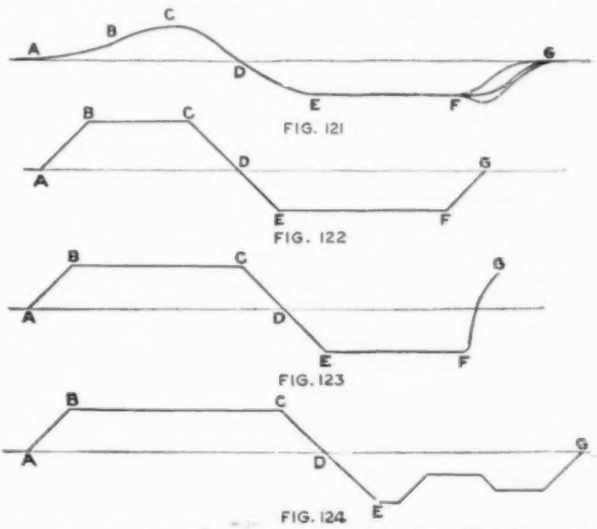


FIG. 121

FIG. 122

FIG. 123

FIG. 124

FIG. 121. PRESSURE DIAGRAM RESULTING FROM SPIRAL TOOTH ACTION. FIG. 122. MODIFICATION OF DIAGRAM WITH SECOND TOOTH ENTERING WORK AT *G*. FIG. 123. SECOND TOOTH ENTERING BETWEEN *F* AND *G*. FIG. 124. SECOND TOOTH BETWEEN *E* AND *F*

minute, then 840 cuts will be taken in one minute and the cycle of changing pressures recurs 840 times in that period of time. These cycles are perfectly marked.

When taking a roughing cut on a lathe there will be some variation in the thickness of metal to be removed, so that the formation of the chips is not always taking place in the same manner. The period of pressure fluctuations is, therefore, not always the same, and under such conditions there is little likelihood that vibrations will be built up. If they start one moment, the next will probably see vibrations of a different frequency started, and they will kill whatever vibrations have begun. We may often notice when there is more metal to be removed on one side of a piece of lathe work than on another, that chatter takes place during a part of the revolution only. Such unevenness of metal to be removed would not prevent the starting of vibrations when we take a milling cut. The milling cutter starts a new cycle at perfectly even intervals, that is, every time a new tooth strikes the work, and entirely regardless of the depth of cut. This is not saying that the unevenness of metal has no effect at all on the vibrations, but that it cannot kill them. A somewhat heavier or shallower cut would make the chip a little longer or shorter, but the beginning of a cycle is controlled only by the number of teeth of the cutter and the cutting speed.

There are other reasons why the milling machine is more liable to chatter than the lathe. Leaving out of consideration the piece of work itself, the lathe presents few elements which are apt to have individual vibration periods. Toolholder, toolslide, carriage, bed, tailstock, and headstock are heavy and irregularly shaped masses of cast iron which have a tendency to absorb vibrations. Even if they are not heavy enough to do this, they are built up out of many webs, ribs, bosses, etc., each of which has its own vibration period, so that it is not likely that a complete member, say a bed, has a vibration period. The vibrations of the long webs will probably be killed by those of the crossribs or ways or flanges. In the milling machine, on the other hand, conditions are much more favorable for the building up of vibrations. There are the arbor, spindle and overarm: simple cylindrical pieces which are easily set in vibration. Besides, these elements are of steel, which, being much more homogeneous than cast iron, is for that reason much more easily set in vibration. Note the ring when a piece of steel is struck by the hammer and the dull sound given out by cast iron. The braces in many existing milling machines are simple straight pieces of cast iron. Though supposed to assist in overcoming chatter, they themselves may be the cause of it. It may well happen that the removal of such braces stops the chatter. Braces of a more complicated pattern are not so apt to give this trouble, though even they, being of single-web design, may sometimes be set in vibration.

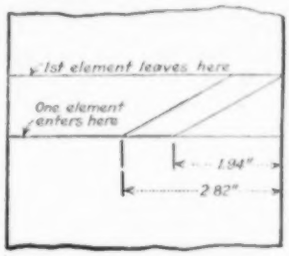


FIG. 125. ENTERING AND LEAVING POINTS OF FIRST AND SECOND TEETH OF EIGHT-TOOTH CUTTER

It is quite commonly thought that chatter in a milling machine is caused by inaccurate gearing, and many mechanics are, for this reason, in favor of cone-driven milling machines, the idea being that finishing cuts can be taken with open belt, thus avoiding chatter caused by the gears. Now, it is true that badly cut or adjusted gears may be noisy and also that they may assist in causing chatter, but they are, as a rule, not the cause of this annoying phenomenon.

The cause of chatter is often sought in looseness of the knee. It is supposed that the knee moves up and down under the alternating up and down pressures between cutter and work. A moment's consideration will show that this can hardly be the case. The idea that the heavy mass of knee, saddle, table and work should move up and down several hundred times, sometimes more than a thousand times a minute, does not seem reasonable. The following observation was made:

A face mill on a vertical milling machine caused chatter marks. The marks were radial, as might have been expected, and were ½ in. apart. The cutter had a speed of 70 ft. per minute, so that these marks were made at the rate of 70 × 12 × 8 per minute, or 6,720 per minute. Such a rapid movement of these heavy masses is unthinkable. It is not at all unthinkable, however, that the number of vibrations of the spindle (much like the vibrations of a bell) should have been that large. A loose knee may have some effect in so far that, there being no solid connection between knee and column, the mass of cast iron which might have absorbed the vibrations was not so great; to that extent a loose knee, or, for that matter, any other loose member of the machine may have helped to make conditions right for chatter, but it was not the source.

Chatter is one of the main troubles and very frequently encountered in milling practice and for that reason is being considered here at some length. In practically all cases the source of chatter must be sought in the conditions under which the milling is being done: in the cutter, feed, speed, arbor, etc. Machine and fixture may be contributing factors but they are not prime causes. If it is found that one machine chatters with a given job while another does not, it is often taken for granted that the second machine must be the better of the two. This may or may not be so. The first machine may show up better with some other job. However, this should not be understood to mean that the construction or design of a machine is of no importance so far as chatter is concerned. It must be heavy and rigid enough for the work, its metal must be properly distributed, its joints must have a minimum amount of looseness—just as is required of any other machine tool; but when all these requirements are met, a milling machine may still chatter.

Remedies for Chatter

If machine and fixture are in good condition, chatter may often be obviated by changing feed or speed or the relation between the two. Reducing the speed, but leaving the feed per revolution the same, changes the period of vibration and may bring it out of consonance with the machine. If, for instance, there is a part of the machine which would naturally vibrate at 840 r.p.m., this member is apt to cause chatter when an eight-tooth cutter revolves 100 r.p.m., but not with a seven-tooth cutter or not at 80 r.p.m. The feed per revolution might be increased, so as not to reduce the output.

Changing the feed, alone, may do away with chatter. Though the frequency is the same the nature of the chip is different. The tooth slides for a longer or shorter time over the work, and the entire sequence of conditions during the separation of one chip has been changed. This may have a tendency to modify the vibrations in such a manner as not to induce sympathetic vibrations in the machine. A little experiment which anyone can carry out may make the foregoing clearer.

Take a hollow object of somewhat irregular form; not a smooth tube, but, for instance, a paper bag slightly crumpled. Place it to the mouth and pronounce a vowel, changing the pitch gradually until a point is reached

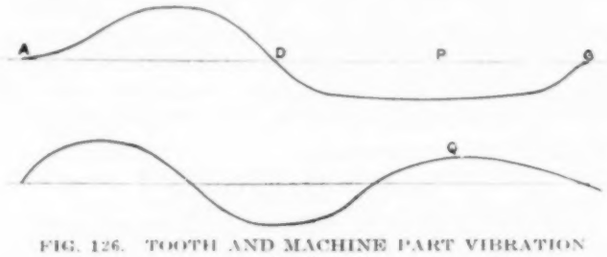


FIG. 126. TOOTH AND MACHINE PART VIBRATION DIAGRAMS

where the sound is full and clear. At that moment the condition prevails where the natural vibrations of the air column, contained in the bag, are in consonance with the tone produced. Now, suppose the vowel *ai* were produced, and that the experimenter should change

over to *O*. He will find that the tone is no longer so clear and full as before. In other words, the column of air is in most perfect consonance when pitch (number of vibrations) and timbre (nature or quality of tone) are both favorable. The cutting speed and number of teeth provide the pitch, and the form, length (along the arc) and thickness of the chip provide the quality, or form of vibration. By changing this quality the consonance may often be broken up. It is quite interesting to see how a chattering milling machine may often be silenced by changing feed, or speed, or both. As a rule it is better to *increase*, rather than to *decrease* the feed, as this will diminish the length of time the cutter tooth must slide over the work.

The reason why this discussion of chatter was linked to the results of winding the cutting teeth spirally around the body of the cutter is, that chatter is very largely obviated by just this method. We have seen how spiral teeth cause the fluctuations in pressure to be ironed out. This alone would reduce the tendency to set up violent vibrations, but there is more. During the time that one spiral tooth goes through the cut a cycle of changes occurs, and this same cycle will occur again when the next tooth acts, etc. Now this cycle is dependent on various items mentioned before, but there was one item which was left out of the discussion: the width of the work.

In Fig. 126, Diagram *P* is a duplicate of Fig. 121, and Diagram *Q* is an imaginary diagram of consonant vibrations of some part of the machine. The upper diagram starts with the entering and ends with the leaving of one tooth. If another tooth enters immediately afterward, the same diagram may be repeated. But the width of the work may be such as to make the second tooth enter a little later or earlier and so there will be two different cycles started: One dependent on the distance between the teeth and the other on the width of the work; and these two cycles must bear a certain relation to each other in order not to kill each other's effect on the natural vibrations of the machine element. The practical application of this fact lies in the possibility of stopping chatter by increasing or decreasing the width of the work. It is true that this is not possible once the work is given in our hands, but it is always possible to place it on the milling-machine table in such a way as to present a width of cut greater than the width of the work, by laying it down at an angle with the direction of feed. This is always possible with a job of slabbing.

Spiral teeth have still another desirable quality. They produce what is called a shear cut. As shear tools will be discussed in another chapter, this point will be passed over for the present.

It would be strange indeed if spiral teeth should have nothing but good qualities. As the chip bears hard against the tooth, and as this is at an angle with the centerline of the spindle, there must be end thrust; and it is sometimes thought that this is of enough importance to keep the spiral angle as low as possible. Tests have shown that the amount of end thrust is so small and its effect so negligible that any angle given to the spiral is safe. To minimize the effect of the end thrust it is well to have the thrust *toward* the column as the thrust bearings of milling-machine spindles are best adapted for that condition. When possible, right- and left-hand cutters should be used in gangs, thus partially or entirely neutralizing end thrust.

Now Is the Time to Replace, Repair and Improve Equipment

Some very sound advice is given in a circular issued by the American Tool Works Co., Cincinnati, Ohio, with the title "An Important Message of Value to You," from which the following paragraphs are taken.

The three dominant factors of production are: (1) Equipment; (2) organization; (3) human element.

It has occurred to us, now the breathing spell following several strenuous years of intensive effort is here, that this is an opportune time to consider preparation for future activities. We have all been so busy during the few years just passed that we have had neither the opportunity nor the time to give the attention to our equipment that it deserves, but, since the pressure of production is relieved, perhaps this is the proper time to consider three important things:

(1) Replacement of old equipment with new and better tools; (2) application of labor-saving and cost-reducing equipment to machine tools now in operation to make them more productive and profitable; (3) repairing of present equipment to make it more serviceable and productive.

We all realize that equipment represents the very heart of our business, and as such we depend upon it to a very great extent for the proper functioning of our plants. Many improvements in machine tools have been made in the past few years, more, in fact, than during any other similar space of time, because the normal development which has been constantly taking place was greatly augmented by the war's insistent demand for more productive and more efficient machine tools.

As a consequence, many machine tools which were looked upon as the last word in development five years ago have been supplanted by new and better designs that produce much more economically and are, therefore, necessary to the shop which would uphold its standards of efficiency and economy.

Let us make the most of the present lull to put our shops in condition to take immediate advantage of the first breezes of better times. We are getting ready now. Are you?

Probably one of the simplest and least expensive ways to reduce the time of machining operations is to supply machine tools with the proper toolholding equipment for the work they are doing, so as to eliminate all unnecessary changing of tools. Every time you make a tool change you lose time—and time is money in a manufacturing plant.

It is estimated that this country between the years of 1915 and 1920 produced the equivalent of 11 normal years' production. Imagine what a tremendous strain was placed upon the equipment of our manufacturing plants! Is it any wonder that a great deal of it shows visible effects of that wear and tear, especially as we were all compelled by necessity to depend largely upon unskilled labor to handle it.

We did not have the time during those five years to make the few repairs here and there necessary to keep our equipment in the best condition; we did only that which was necessary to keep it running day and night. If it deteriorated faster than it should, we did not care so long as it produced. If it looked bad and detracted from the appearance of our shops we did not worry if it would only stick to the job and keep running. Now, however, things are different. Every conscientious shop executive wants to have his equipment in good repair. Not only does he feel a natural pride in the appearance of his shop, but he knows that the cost of his production depends largely upon the condition of his equipment, and, further, he realizes that if he is to develop and maintain a high morale in his shop he must have his equipment in perfect condition and must insist upon his operators keeping it so.

On Feb. 1, 1921, the money in circulation in the United States totaled $6,141,265,012, as against $6,340,436,718 on Jan. 1, and $5,864,171,213 one year ago. Based upon a population of 108,000,000 the amount in circulation per capita on Feb. 1, 1921, was about $56.85 and on Jan. 1, 1921, it was about $58.70.—*From the Journal of the American Bankers Association.*

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Finding Dimensions on Profiles

By W. G. Holmes

In the making of gages, as explained in my article, 'Finding Dimensions of Profile Gages," *American Machinist*, page 567, dimensions locating differ-

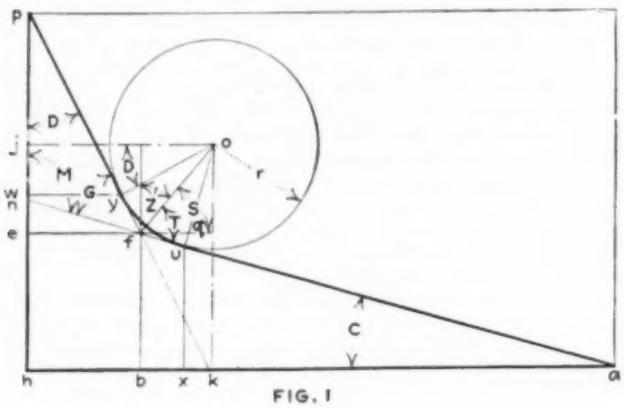


FIG. 1

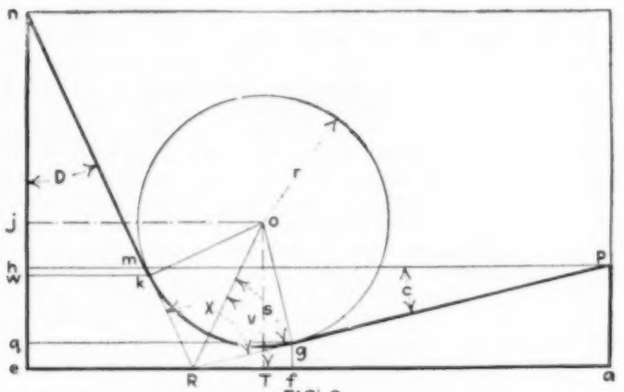


FIG. 2

FIG. 1. GAGE OUTLINE EQUAL TO 90 DEG. + C + D
FIG. 2. GAGE OUTLINE EQUAL TO 90 DEG. + D—C

ent points are required in order that accuracy may be assured. Below are given formulas which can be given to determine any dimension which may be required in the two types of gages considered. It is hoped that the formulas will be of material assistance to those who have problems of profile gages, forming tool outlines and similar contours.

Given a profile gage with the outline having the form of two lines joined by a circular arc, as in Fig. 1, the two lines forming an angle of 90 deg. + C + D. The values known are ha, hp, C, D, and r; in order to make and check the gage it is necessary to know the location of the center of the circle, or the dimensions pj and jo; the location of the point of tangency u or the dimensions hx and xu; the location of the point of tangency y, or the dimensions pw and wy; and the location of the point of intersection f, or the dimensions pe and ef.

The formulas expressing the values of these eight dimensions in terms of the known dimensions are as follows:

$$M = 90^\circ + C$$

$$G = 180^\circ - (D + M)$$

$$T = \frac{90^\circ + C + D}{2}$$

$$S = T - C$$

$$Z = \frac{90^\circ + C + D}{2} - D = T - D$$

$$pj = hp - jh \quad (1)$$

$$= hp - he - je \quad (2)$$

$$= hp - (he - pn - ne) - fo \cos Z \quad (3)$$

$$= pn + ne - fo - \cos Z \quad (4)$$

$$= hp - hn + fn \sin C - r \operatorname{cosec} T \cos Z \quad (5)$$

$$= hp - A \tan C + \frac{np \sin D \sin C}{\sin G} - r \operatorname{cosec} T \cos Z \quad (6)$$

$$= hp - A \tan C + \frac{(hp - ha \tan C) \sin D \sin C}{\sin G} - r \operatorname{cosec} T \cos Z \quad (7)$$

$$jo = hb + bk \quad (8)$$

$$= fn \cos C + fo \cos S \quad (9)$$

$$= \frac{np \sin D \cos C}{\sin G} + r \operatorname{cosec} T \cos S \quad (10)$$

$$= \frac{(hp - ha \tan C) \sin D \cos C}{\sin G} + r \operatorname{cosec} T \cos S \quad (11)$$

$$hx = hb + bx \quad (12)$$

$$= fn \cos C + fu \cos C \quad (13)$$

$$= \frac{np \sin D \cos C}{\sin G} + fo \cos T \cos C \quad (14)$$

$$= \frac{(hp - ha \tan C) \sin D \cos C}{\sin G} + r \operatorname{cosec} T \cos T \cos C \quad (15)$$

$$xu = he - uq \quad (16)$$

$$= hp - pn - ne - bx \tan C \quad (17)$$

$$= hp - (hp - ha \tan C) - fn \sin C - fu \cos C \tan C \quad (18)$$

$$= ha \tan C - \frac{np \sin D \sin C}{\sin G} - fo \cos T \cos C \tan C \quad (19)$$

$$= ha \tan C - \frac{(hp - ha \tan C) \sin D \sin C}{\sin G} - r \operatorname{cosec} T \cos T \cos C \tan C \quad (20)$$

$$pw = pj + jw \quad (21)$$

$$= pj + r \sin D \quad (22)$$

$$= hp - ha \tan C + \frac{(hp - ha \tan C) \sin D \sin C}{\sin G}$$

$$= -r \operatorname{cosec} T \cos Z + r \sin D \quad (23)$$

$$wy = jo - r \cos D \quad (24)$$

$$= \frac{(hp - ha \tan C) \sin D \cos C}{\sin G} + r \operatorname{cosec} T \cos S - r \cos D \quad (25)$$

$$pe = pn + ne \quad (26)$$

$$= hp - ha \tan C + fn \sin C \quad (27)$$

$$= hp - ha \tan C + \frac{np \sin D \sin C}{\sin G} \quad (28)$$

$$= hp - ha \tan C + \frac{(hp - ha \tan C) \sin D \sin C}{\sin G} \quad (29)$$

$$ef = fn \cos C \quad (30)$$

$$= \frac{np \cos C \sin D}{\sin G} \quad (31)$$

$$= \frac{(hp - ha \tan C) \cos C \sin D}{\sin G} \quad (32)$$

Given a profile gage with the outline having the form of two lines joined by a circular arc, as in Fig. 2, the two lines forming an angle of 90 deg. $+ D - C$. The values known are *ea*, *nh*, *C*, *D* and *r*. In order to make and check the gage it is necessary to know the location of the center of the circle, or the dimensions *nj* and *jo*; the location of the point of tangency *y*, or the dimensions *nq* and *qy*; the location of the point of tangency *k*, or the dimensions *nw* and *wk*; and the location of the point of intersection *g*, or the dimensions *ne* and *er*. The formulas expressing the values of these eight dimensions in terms of the known dimensions are as follows:

$$X = 90^\circ + D - C$$

$$S = \frac{X}{2}$$

$$V = S + C$$

$$nj = nh + eh - to \quad (33)$$

$$= nh + mg \cos D - go \sin V \quad (34)$$

$$= nh + \frac{mp \sin C \cos D}{\sin X} - r \operatorname{cosec} S \sin V \quad (35)$$

$$= nh + \frac{(ea - hm) \sin C \cos D}{\sin X} - r \operatorname{cosec} S \sin V \quad (36)$$

$$= nh + \frac{(ea - nh \tan D) \sin C \cos D}{\sin X} - r \operatorname{cosec} S \sin V \quad (37)$$

$$jo = eg + gt \quad (38)$$

$$= (eh + nh) \tan D + go \cos V \quad (39)$$

$$= nh \tan D + eh \tan D + go \cos V \quad (40)$$

$$= nh \tan D + mg \cos D \tan D + r \operatorname{cosec} S \cos V \quad (41)$$

$$= nh \tan D + \frac{mp \sin C \cos D \tan D}{\sin X} + r \operatorname{cosec} S \cos V \quad (42)$$

$$= nh \tan D + \frac{(ea - nh \tan D) \sin C \cos D \tan D}{\sin X} + r \operatorname{cosec} S \cos V \quad (43)$$

$$nq = nh + eh - fy \quad (44)$$

$$= nh + mg \cos D - gy \sin C \quad (45)$$

$$= nh + \frac{gp \sin C \cos D}{\sin X} - go \cos S \sin C \quad (46)$$

$$= nh + \frac{(ea - nh \tan D) \sin C \cos D}{\sin X} - r \operatorname{cosec} S \cos S \sin C \quad (47)$$

$$qy = eg + gf \quad (48)$$

$$= (eh + nh) \tan D + gy \cos C \quad (49)$$

$$= nh \tan D + eh \tan D + gy \cos C \quad (50)$$

$$= nh \tan D + \frac{mg \cos D \tan D}{\sin X} + go \cos S \cos C \quad (51)$$

$$= nh \tan D + \frac{(ea - nh \tan D) \sin C \cos D \tan D}{\sin X} + r \operatorname{cosec} S \cos S \cos C \quad (52)$$

$$nw = nh + eh - ew \quad (53)$$

$$= nh + mg \cos D - gk \cos D \quad (54)$$

$$= nh + \frac{mp \sin C \cos D}{\sin X} - go \cos S \cos D \quad (55)$$

$$= nh + \frac{(ea - nh \tan D) \sin C \cos D}{\sin X} - r \operatorname{cosec} S \cos S \cos D \quad (56)$$

$$wk = nw \tan D \quad (57)$$

$$= \left[nh + \frac{(ea - nh \tan D) \sin C \cos D}{\sin X} - r \operatorname{cosec} S \cos S \cos D\right] \tan D \quad (58)$$

$$ne = nh + eh \quad (59)$$

$$= nh + mg \cos D \quad (60)$$

$$= nh + \frac{mp \sin C \cos D}{\sin X} \quad (61)$$

$$= nh + \frac{(ea - nh \tan D) \sin C \cos D}{\sin X} \quad (62)$$

$$eq = ne \tan D \quad (63)$$

$$= \left[nh + \frac{(ea - nh \tan D) \sin C \cos D}{\sin X}\right] \tan D \quad (64)$$

Re-grinding Valves

By H. S. Trecartin

Notwithstanding the high degree of accuracy obtainable in a properly equipped machine shop, it is difficult to obtain, between two metallic surfaces, the intimate contact essential to a watertight or steamtight joint without recourse to grinding. Valves used for the control of liquids are dependent upon the accurate contact of their surfaces for their "tightness."

Valves can be reground by hand with little trouble if the work is rightly gone about, but the correct methods are little understood by most mechanics. The principle causes of failure in grinding valves are, (a) the use of too much grinding compound, (b) grinding too long without re-distributing the compound, and (c) failure to observe care in keeping out foreign substances during the grinding.

The grinding of a leaky stopcock will be described, taking up the important points as they occur.

Re-grinding a Stopcock Valve

The nut on the end of the plug is screwed off and the plug removed from the body. A very small amount of grinding compound is spread evenly with the finger over the surface of the plug. A grinding compound sold by automobile supply houses for grinding gas-engine valves may be used, but it is best to use a grinding mixture which is especially prepared for this purpose by a large manufacturer of valves, and procurable in plumbing supply stores.

The plug is inserted in the valve and the grinding commenced. A small wrench may be used to turn the plug. The manner of doing this grinding is important. If the plug is rotated steadily in place, it will be found almost invariably that grooves will be cut in the surfaces. This is caused by the abrasive tending to gather in spots and to "ball." To prevent this the plug should be rotated back and forth three or four times, then slightly withdrawn and pushed back in a different position. This will tend to redistribute the cutting compound and will replace it on the high spots, which are the places that must be cut down.

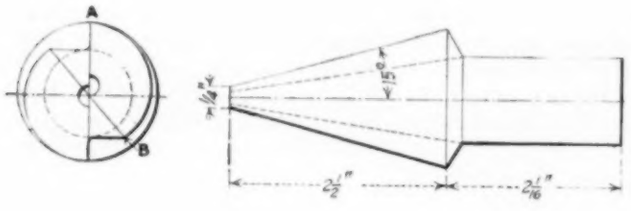
When the plug begins to stick or turn hard, it should be removed and wiped clean. The body should also be cleaned. An inspection of the surfaces should be carefully made. If it is seen by the bright marks that a sharp "high spot" is scratching one of the parts, the spot should be located and carefully removed. A fine file will do this if it is on the plug, or a smooth scraper will remove it from the inside of the body. If the surfaces appear to be touching fairly well all over, they may be finished to a closer contact by thinning the abrasive mixture with an equal amount of oil, and applying to the plug an exceedingly small amount. This should be ground in again, withdrawing the plug slightly every few turns. The surfaces should then be cleaned, using gasoline if available. Then a coating of clean soap should be applied and the grinding action gone through with again. After cleaning, a coating of oil should be put on, and the valve may be re-assembled.

Sometimes the plug will wear a slight depression in the body where it turns and the grinding will deepen this seat, leaving a ridge or shoulder on the body at the small end of the plug. The grinding will not cut this shoulder down much, and the end of the plug will abut against it and cannot sink into its seat as it should. When this condition occurs the shoulder should be removed from the inside of the body by carefully cutting it out with a scraper.

Backing Off a Cutter on the Milling Machine

By Joseph A. Olberding

Having some die sinking cutters to relieve and not having a backing-off lathe heavy enough to handle the job, we got very satisfactory results by relieving them



on a milling machine, using a circular table and vertical attachment. We used a long end mill ¾ in. in diameter, and set our vertical head at the desired angle of 15 deg. We then put on the circular table and clamped the dividing head on it slightly off center (a few trials will give the desired amount of clearance).

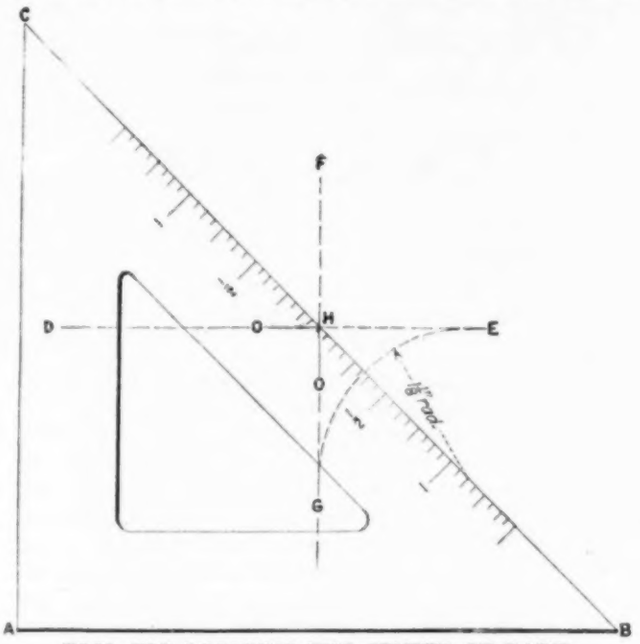
After relieving one side beginning at *A* and feeding the circular table toward *B* we backed up and indexed to the other flute and finished it in the same manner.

The result was a very good job which did not take much time.

Locating the Center of Radii—Discussion

By E. H. Weber

Referring to the article on locating the center of radii, by Chester E. Josselyn, page 1084, Vol. 53, of *American Machinist*, it seems to me that my method of



TOOL FOR LOCATING THE CENTER OF RADII

doing this has some advantages over the method given by Mr. Josselyn.

The sketch shows a 45-deg. triangle with graduations on the long side running both ways from a zero point at the center, these graduations being the secants of 45-deg. angles, or 1.4142 times the inch graduations obtained by projecting from the side *AB* to the side *CB* and then drawing the graduation marks at right angles to the side *CB* at the points of intersection of the projected scale with the side *CB*.

The triangle is used for locating radii where the tangents of the radii are at an angle of 90 deg. by positioning the zero lines to coincide with the tangent lines and then locating the center of radii by the graduation on the side *CB*, which bisects the angle included by the tangent lines.

The same method may be used on a 60-deg. triangle. I arranged one with two scales on its long edge, one at either end. One scale consists of the secants of 30-deg. angles, which are 1.1547 times the inch scale. The other scale consists of the secants of 60-deg. angles, which are twice the inch scale.

The former scale is used in locating radii between tangents that are at an angle of 120 deg., and the latter when the tangent lines are at an angle of 60 degrees.

Beyond the Toolpost

By J. C. Nicholson

The common toolpost on most lathes sometimes falls short when it is necessary to use a very long boring tool or to turn work which is almost as large as the lathe will swing. Of the various makeshifts used in such emergencies the one shown herewith has some good features.

Fig. 1 is a rear end view of the device mounted on the toolrest and Fig. 2 a top view. The construction is

simple for almost any ordinary shop. Two pieces of bar steel *A* about ½ x 1¾ in.—if the lathe is from 18- to 24-in. swing—are bent U-shape and then fastened together by a piece *B* of the same size with countersunk head screws *C*.

After these parts are assembled holes are drilled for the setscrews *D* and *E* and for the studs *F*, which are screwed into a plate *I* suitable to enter the toolrest slot. A round toolbar *G* or holder is clamped on a V-plate *H* as shown in Fig. 1, or if so desired a square or rectangular bar may be used instead without a V-plate. Vertical adjustment is by means of liners or shims placed under the toolbar or under the V-plate or between the toolrest and the entire device. Also some such adjustment may be had by turning the round bar in the V-plate.

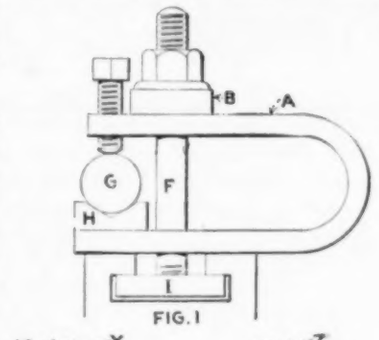


FIG. 1

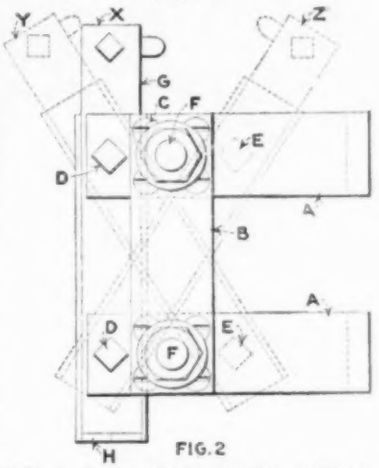


FIG. 2

FIG. 1. REAR-END VIEW OF TOOL CLAMPING RIG

FIG. 2. TOP VIEW OF TOOL CLAMPING RIG

The sketches show the toolbar in position *X* (Fig. 2) as it is used in turning work of large diameter, the bar being behind the toolrest slot in order to place it as far out as possible from the center line of the lathe. When used for boring the entire device is merely turned halfway around and the toolbar turned end for end in it, though it may be merely moved to the other side of the studs and setscrews *D* changed to positions *E*, or in most cases it may be left in the same position as for turning, and the cutter merely reversed. If for any reason it is necessary to machine a steep external or internal taper or any irregular concave or convex surface the bar may be shifted with some advantage to positions *Y* or *Z* as the case may demand.

The rig holds the bar very firmly, allows it to be overhung, little or much, as the case demands, and will hold as large a bar as one is ever likely to need.

Individual or Group Motor Driving

BY FRANK C. HUDSON

One of the questions which arises in every shop is that of the relative value of individual or group driving for machine tools. Those who are taking advantage of the present lull to rearrange their shop layout, are doubtless giving it careful consideration at the moment.

The more conservative lean toward group driving and it seems to have much in its favor, especially in the matter of first cost. In shops which have both systems, however, there is a decided tendency to change to the individual motor drive even on small tools.

The cost of belting has increased considerably over pre-war days and there is the constant cost of maintenance which must be reckoned with. One superintendent of production states that he believes the cost of motors and wiring is not much more than belting, countershafts, etc., at the present time. The cost of motor repairs he considers lower than belting.

The absence of belting and countershafts, and the dirt which they deposit on the walls and ceilings, adds much to the appearance of a shop. The changing of speeds by push button or controller, insures their being changed more frequently, and there is an added element of safety which counts in its effect on the men.

There is always something attractive about a motor-driven shop with the absence of lineshafts, countershafts and belting. The tendency which is unquestionably in that direction, should be noted and studied by those who are making or contemplating changes.

This does not mean the elimination of belts. There are many places where the belt gives just the smooth, flexible transmission needed to secure the best results. Belting still has its place. But just as the milling machine has taken a portion of what was formerly planer work, so is the direct-motor drive taking over work where the belt was the only known method of securing results.

An Approximation Gage for Center Distances

BY JAMES MCINTOSH

There are many methods of measuring center distances, some of which are very efficient so far as results are concerned but are too slow and unwieldy for general use. The gage shown in Fig. 1 gave good results for the work for which it was designed. When the gage is in contact at point *A* the center distance *B* is

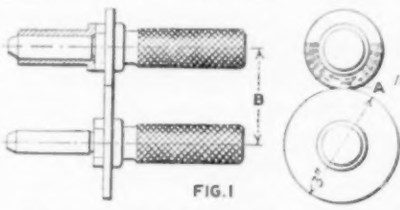


FIG. 1

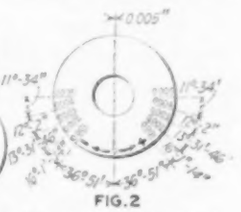


FIG. 2

FIG. 1. A GAGE WHICH CAN BE USED RAPIDLY AND EFFECTIVELY FOR GAGING CENTER DISTANCES

FIG. 2. LAYOUT FOR GRADUATING 2-IN. DIAMETER ECCENTRIC DISK

2.500 in. and has a range graduated to minus 0.005 in. or plus 0.005 in. Fig. 2 shows how the eccentric disk was graduated.

Milling Cams for Automatic Screw Machines

BY ERNEST C. ALLEN

In the shop where the writer is employed we have recently taken to milling the automatic screw machine cams instead of drilling and filing as has been the custom. The angles for setting up are computed as usual and are mathematically correct. It is seldom, however, that cams milled to the angles given attain the correct size, it generally being necessary to juggle back or forth a degree or so to get correct results. The trouble does not seem to be due to any deflection of the machinery as it would then be always in one direction, but occurs with total inconsistency. It is causing us considerable loss of time and I hope some of your readers may have found a solution for a similar difficulty.

IN THIS ISSUE

WE ADD to a record that we regard with some satisfaction by again opening the editorial section with the description of a machine just being introduced to machine tool users—this week the Rockford Milling Machine Co.'s No. 3 "High-Power" milling machine. This is the fifth of the last eight issues to carry as the leading article a description such as referred to—articles that are possessed of a high degree of news and information value.

How do you make your profits? W. R. Basset has written a splendid article with this question as title. He compares small profit on large turnover to large profit on small turnover, tells what the average return to a well-managed company should be, and makes some general statements about manufacture that will be recognized as true, although too frequently receiving less attention than they merit. Mr. Basset says: "I have more than once been surprised at the large number of these (manufacturing enterprises) which return to their owners an income much less than the savings bank interest on the money invested. . . . The unusually high earnings are achieved by those concerns which take a moderate profit on each sale, but turn their entire capital rapidly. . . . On the whole, machine shops require a heavier fixed investment than do most other industries. . . . In the machine shop industry most of the men I know feel that they should get from 20 to 25 per cent on the money they have invested. . . . In a competitive business the only possible way that I can see by which anything like so high a profit on sales could be realized would be if every manufacturer accurately knew his costs and was determined to get a price which would return that profit." "How Do You Make Your Profits?" begins on page 588.

A three-part combination article on bearing practice in railroad shops, by Hunter, begins on page 590. It is a comparison of the methods used in three middle western shops, the Wabash shops at Decatur, Ill., the Beach Grove shops of the Big Four at Indianapolis, Ind., and the Chicago & Alton shops at Bloomington, Ill. There are only seven pages devoted to the article and they are well laden with statements of facts and valuable illustrations.

Stanley has an article on press tools for a ball spacer for typewriters, page 597. He describes two-stage blanking tools, piercing tools for the central opening and rack surface and the first operation forming tools. He also furnishes a drawing of the layout for the piercing tools and a diagram of the piercing operations.

The article on press tools is followed by one on burnishing-broaches, written by Dixie, beginning on page 599. Dixie tells how to make and use burnishing-broaches, about the kinds of spoiled work that may be reclaimed by their use and about the turning of broached work with diamond tools. "It is surprising," he says, "how little knowledge there is among mechanics regarding burnishing-broaches. Not only are they easy to make and use, but a knowledge of their application often means the saving of a job which has been made too small or too large."

The Blanchard chuck is taken up by Sheldon this week in his fifth installment on magnetic chucks. The construction of the Blanchard chuck and the methods by which it is made seem to have afforded just the material needed to enable Sheldon to write another of his interest-compelling articles. Page 602. The story is too long for one issue—it will be concluded next week.

The third of Colvin's automobile transmission articles begins on page 606. It has to do entirely with gears. The subject is well handled and the article, like the preceding ones, is thoroughly illustrated.

DeLeeuw's seventh article on metal cutting tools is concluded this week. You will remember that the article as a whole deals with milling cutters. The part published this week has to do chiefly with the causes of chatter and the remedies therefor. Page 610.

Beginning in page 624a we have articles on business conditions in England, the reconstruction of the Krupp Works at Essen and the condition of the railroads in Soviet Russia by our correspondents in London, Berlin and Riga. All are very interesting articles and they show that European conditions are indeed unsettled.

Coming Features

Next week we are to have the first of several articles on the Rolls-Royce Co. of America, at Springfield, Mass Colvin has called his first story "Transplanting Rolls-Royce Methods to the U. S." He says, of the first American chassis, that was completed in January, "It is so nearly a duplicate of its English mate that not even those who are thoroughly familiar with the car can tell them apart except for certain small earmarks which have nothing whatever to do with either the appearance or quality." That such results have been accomplished indicates that we are to have in this and the future articles on the Rolls-Royce some very absorbing stories.

A new contributor will be introduced next week. He is Joseph K. Wood, who has specialized on the design of helical springs, and who is now about to make public through the *American Machinist* his methods of design.

Among the other complete articles will be one on tools and operations in a railroad blacksmith shop by Stanley and some special correspondence on methods of motor assembly.

Of series articles there are to be the seventh part of "The Foreman and His Job" and the eighth of "Metal Cutting Tools."

EDITORIALS

We Should Make Haste Slowly with Immigrant Legislation

THE emergency immigration legislation rushed through at the last moment by Congress died by "pocket veto." While it may be advisable to put some new immigration legislation on the statute books we feel that it should be based on more deliberate consideration and on unquestionable facts.

The immigration question is one of the most complicated with which we as a nation are called upon to deal. It will not do to tackle it in our usual slap-dash, inaccurate way. We have been able to dispose of some of our domestic problems temporarily by such methods, but here we must fence with skilled antagonists—the emigration countries. Most of them have devoted much thought to emigration matters and have worked out clearly defined policies which may possibly be adverse to our best interests. The principal source of wealth in some of the emigrant nations lies in their productive labor. They cannot be blamed for protecting themselves from its permanent loss.

It will be as well, then, to make haste slowly in drawing and acting on bills regulating immigration. Legislators must not be swayed by partisan appeals or the demands of selfish class organizations. In this case at least the call of the country as a whole should receive the undivided attention of the representatives of the people. Any other course may lead to endless misunderstanding and friction with other nations, and we should be the last people on earth to do anything that would add to the ill-feeling which undoubtedly exists in certain quarters.

The foreign populations of some of our cities are nearly as large as those of the capital cities of the immigrants' home countries. Some of the suggested legislation will hit many of our most industrious citizens in a tender spot and will do little to increase the regard in which we are held abroad. The world has grown smaller since the war. We are more dependent on foreign markets to absorb our manufactures and consequently should not be hasty in passing laws that will endanger those markets.

Reducing Production Costs

Getting along with old machinery is one of the most expensive "economies" any machine shop can practice. Refusing to scrap machines which have outlived their usefulness is not practicing thrift and it's about as useful as hoarding old collar buttons.

How many shops do you know that scrap machinery when it has outlived its six to ten years' usefulness according to depreciation charges each year? The trouble is that shop managers think they are putting one over on the tax collector when in reality they are only cheating themselves.

There's only one way to get business when competition is keen—to be able to bid low and to make a profit on the job. This means that production costs must be low and this in turn means up-to-date machinery of every kind.

The shops which have put off getting proper machinery so as to have a small inventory may find it a case of paper prosperity. Shops which have replaced machine equipment as it wore out can do work much more efficiently.

Now is the time to remedy the mistakes of the past in this direction. New equipment may mean the difference between success and failure. The cost of production must be reduced and new machinery is the most efficient way of doing it.

Cut Production Costs—
With Modern Equipment

Increasing Capital Turnover To Get a Fair Return on the Investment

ON ANOTHER PAGE we have an article on the subject of what constitutes a fair return on the capital invested in a manufacturing enterprise. To the manufacturer of machinery and machine tools the problem of making a decent living from his business has always been a hard one and to some it has meant returns that were less than savings bank interest on the capital invested.

Working for the love of work is a praiseworthy action from a moral point of view, but carrying on a business that does not make a profit is sheer economic waste as it ties up valuable capital that might be utilized to better advantage elsewhere. It should be borne in mind that the companies analyzed in the article are engaged in all fields of industry. Not more than 15 per cent of them are in the metal trades and only one or two of these are machine-tool builders. As a consequence the rates of capital turnover attained in some instances are hardly applicable to machine-tool plants where one complete turnover annually is an exceptional achievement. In any event, however, the principle of striving to secure a maximum turnover of the working capital is sound and merits the careful consideration of the machine-tool builder.

As the author of the article points out, the amount of time lost between operations is often a serious factor and may be reduced appreciably by careful planning. Better tools may release more working capital than they tie up. More scientific purchasing will reduce the amount of capital frozen in inventories. Although the saving in each department may be small, taken together they are quite likely to turn the balance from loss to profit and pull the company through the difficult days which intervene between the present and the return of normal business. Machine tool builders are almost unanimous in their desire to maintain the wages of their skilled mechanics and rightly so for a contented man in the shop can do much to help the boss speed up material and capital turnover.

Shop Equipment News

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval. Brief descriptions appear later in Condensed Clipping Index in both American and European editions.

Whitcomb-Blaisdell 32 x 32-In. x 10-Ft. Planer

The Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass., has recently brought out an additional size and improved its second-belt-driven planer, which is shown in the illustration. Though the second belt is retained, there is an additional reduction obtained by gearing. The cushioning effect of the second belt is said to reduce the shock of reversal.

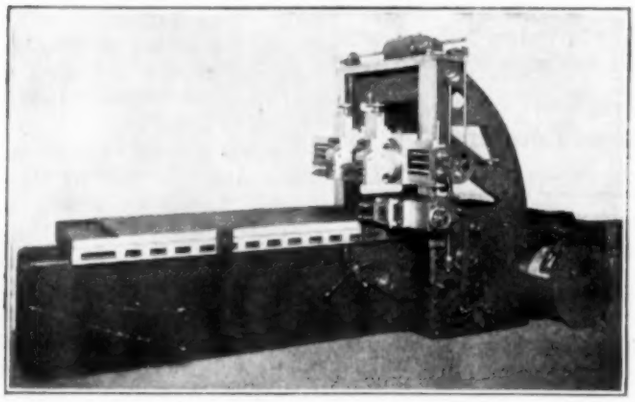
The bed is of the box type, closed at the top and open at the bottom except for a short space at the center of the bed where the bottom is closed to form an oil pocket, open at the top to accommodate the bull- and second-reduction gears. The second belt is outside the housings as in the standard machines.

The table is of box section, of extra width and depth, and is heavily ribbed to prevent springing. T-slots are planed from solid metal and the center slots extend over the full length of the bed. The housings are of box form and are tied together at the top by an unusually heavy tie bar, rendering the machine rigid under maximum cuts with the cross-rail at extreme height.

The Whitcomb patent lever binder is used to lock the cross-rail, and self-locking table dogs are provided so that a wrench is not needed to make adjustments.

The machine will plane work 32 in. wide, 32 in. high and 10 ft. long. It can be furnished with belt or motor drive. It has two heads on the cross-rail and may have independently operated side heads on one or both uprights. In the motor driven machine the motor is mounted on brackets at the top of the housings. Gear guards (not shown in the illustration) are provided to cover all exposed gearing in the feed train.

Driving pulleys accommodate a 3-in. belt. The countershaft runs at 500 r.p.m. and gives a cutting speed

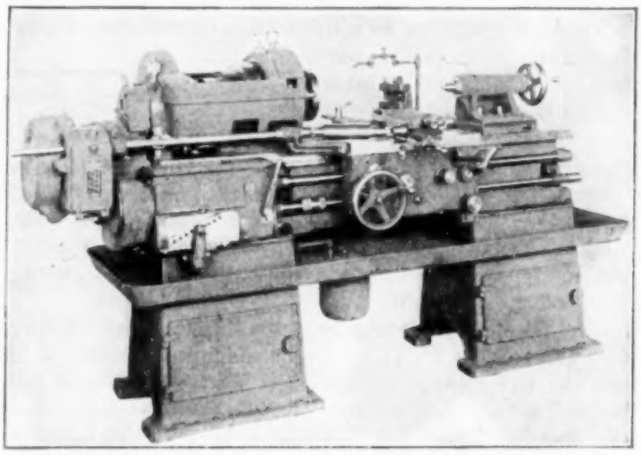


WHITCOMB-BLAISDELL PLANER

of 50 ft. per minute. The weight of the machine is 17,500 lb., and the bed occupies a floor space of about 7 x 16 ft. A 15-hp. motor is required to drive it.

Reed Prentice 14-In. Cone Head Toolroom Lathe

The Reed-Prentice Co., Worcester, Mass., has added to its line the 14-in. toolroom lathe shown in the accompanying illustration. It differs from the standard lathe



REED-PRENTICE-CONE HEAD TOOLROOM LATHE

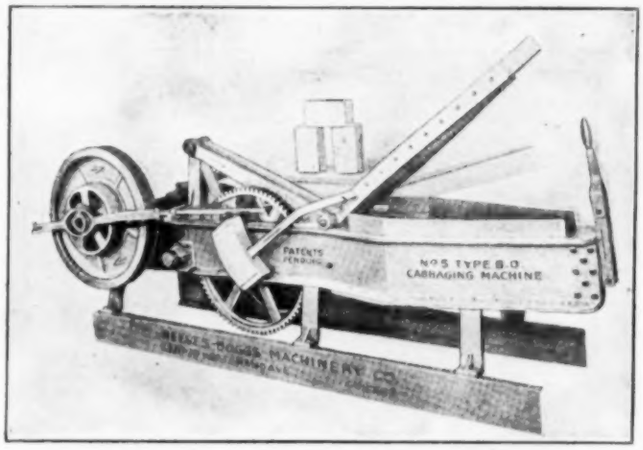
of that type and size only in having a head fitted with a four-step cone instead of having the regular geared head for constant speed drive. The largest diameter of the cone is 8⅛ in. and the smallest 4¼ in. The steps take a 2½-in. belt. The front bearing is 2⅛ x 4⅞ in., and there is a 1¼-in. hole clear through the spindle. Countershaft pulleys are 12 in. in diameter for a 3½-in. belt. Normal speed of countershaft 196 r.p.m. The weight of the machine with 6-ft. bed, compound rest, but without other attachments is 2,850 lb. All accessories including backing-off attachment are supplied.

Reeves-Boggs Scrap-Baling Press

The baling press or cabbaging machine shown in the illustration is made in four sizes by the Reeves-Boggs Machinery Co., 2926 Grand Ave., Chicago, Ill. The two smaller sizes make bales 5 x 5 x 10 and 5 x 5 x 12 in. in size, respectively, and are intended for baling skeleton punchings of sheet brass, copper, aluminum or other soft metals. The two larger presses make bales of 12 x 12 x 12 and 14 x 14 x 16 in., respectively, and will handle sheet-metal scrap of 14 gage and lighter. The machine is belt driven with the pulley face finished on the rim of the flywheel, which is connected with the driving shaft through a lever-controlled clutch.

The baling pressure is exerted by two side wings that are closed in by wedge-like slides carried by the ram, which is at the same time advancing and exerting pressure on the end of the bale. During the squeezing operation, the scrap is held down by a cover plate that is locked by the lever located on the right-hand end of

the machine. When the baling operation is finished and the ram has returned to its starting position the cover-locking lever is released and counterweights swing the cover plate up and out of the way for the removal of the

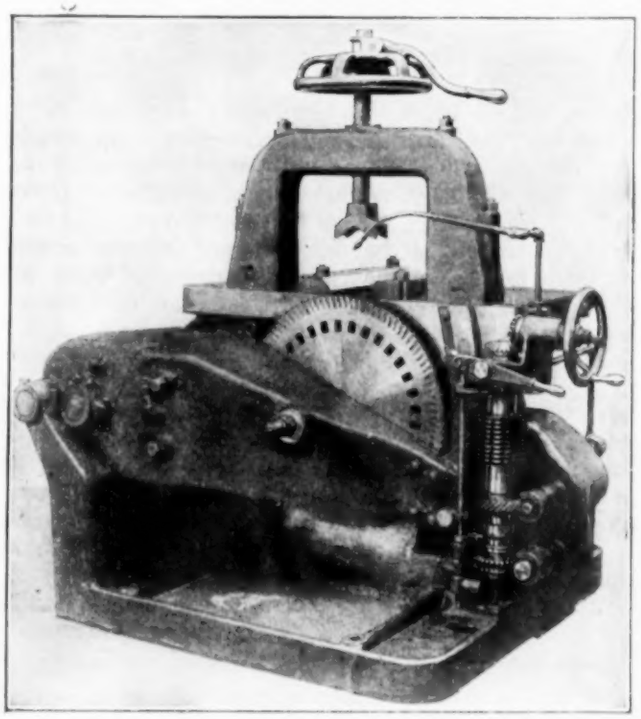


REEVES-BOGGS SCRAP-BALING PRESS

bale. A special attachment that operates by a foot lever can be applied, which is so arranged that it will lift the bale out of the machine that it may be more readily removed. All gears used on the machine are cut from the solid. The flywheel pulley is 30 in. in diameter with a 4½-in. face; and runs at 450 r.p.m. Five horsepower are required. The net weight for two smaller sizes is 3,500 lb., and for the larger sizes, 4,000 and 6,000 lb respectively.

Earle No. 26 "Lea-Simplex" Cold Saw

The Earle Gear and Machine Co., Stenton and Wyoming Aves., Philadelphia, Pa., has lately placed on the market the cold saw illustrated herewith.



EARLE NO. 26 "LEA-SIMPLEX" COLD SAW

Specifications: Saw, 26 in. in diameter. Work table: width, 22 in.; length, 44 in.; height, 35 in. Space under clamp yoke, 14½ x 18½ in. Floor space: belt driven, 60 x 72 in.; motor driven 48 x 72 in. Driving pulley: speed, 116 r.p.m.; diameter, 24 in.; face 6 in. Weight, 4,500 pounds.

The fixtures for clamping the work are conveniently arranged; the T-slots in the table permit holding the stock in any position and at any angle and the clamp screws can be tightened sufficiently to hold the work without the use of a bar or lever. The machine is provided with both a power and a hand traverse, a feed trip and a power return. By means of a quick-change device the feed can be varied from ½ to 1½ in. per minute and the changes can be made while the saw is cutting. All operating levers can be reached from one point and one attendent can operate several machines. The machine may be driven by either belt or motor.

Pawling & Harnischfeger Safety Crane Cab

The Pawling & Harnischfeger Co., Milwaukee, Wis., has developed a crane cab in which the entire controller equipment and current-carrying parts are enclosed, as shown in Fig. 1, the arrangement being intended to provide a maximum of safety for the operator. The

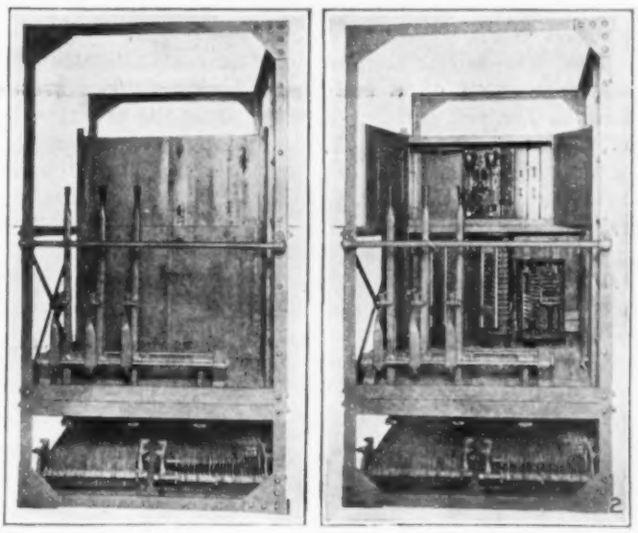


FIG. 1. ALL LIVE PARTS ENCLOSED IN CABINETS AT REAR. FIG. 2. CABINETS OPEN, SHOWING ACCESSIBILITY

main switch, which is of the safety type, is operated by a lever extending through the switchboard cabinet.

The control levers are placed at the front of the cage and allow the operator an unobstructed view of the floor and the movements of the crane hook. All parts are accessible, the opening of the rear doors exposing the live parts for inspection and adjustment, as shown in Fig. 2. Access to the wiring, which is at the rear, can be had by removing a panel.

Hollingworth 28-In. Heavy-Duty Shaper

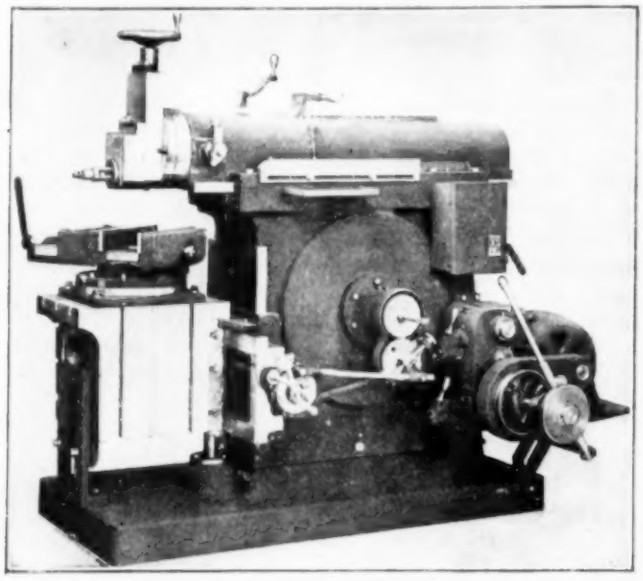
A 28-in. shaper intended for heavy-duty service is made by the Hollingworth Machine Tool Co., Covington, Ky., and is an addition to a line that already embraces 12, 14, 16, 18, 21 and 24-in. shapers. It is stated that changes have been incorporated in the design of the machine to insure rigidity and accuracy. The machine is furnished either cone-pulley or single-pulley driven, the latter type obtaining speed changes by the incorporation in the drive of a gear box with four speed changes. The single-pulley-driven type of machine may be fitted with direct motor drive, as shown in the illustration.

The shaper is of the crank type and fitted with back gears, so that with the four changes in the gear box or the four steps on the cone pulley there are a total of eight speeds available. The ram has a quick return stroke, and its rocker arm pivots on a shaft at the bottom of the column and supporting all of the weight of the arm. It is claimed that the double-link connecting the rocker arm and the ram tends to neutralize the upward thrust of the tool. The rocker arm is of the open-pattern type, ribbed on each side, and has adjusting bolts for taking up wear. The ram is fitted in square ways with taper gibs that have but one screw each for adjustment. The toolhead is graduated and swivels to any angle up to 90 deg. The feed screw has a micrometer dial that is graduated to show thousandths of an inch.

The table is slotted on the top and both sides and can readily be removed when its use is not desired. It is bolted to a slotted saddle that can be used also for bolting up work. The vise is mounted on a swivel base graduated for the complete circle. Its upper jaw is scraped to a fit on the lower jaw and is held in place by steel gibs.

The cross-rail is elevated by means of a telescoping screw mounted on a ball-thrust bearing. The cross-feed on the rail can be changed while the machine is in motion, being controlled by lifting and turning a pawl. The crank arm for the feed crank is adjusted by a screw, so that the operator can set the pawl for any desired number of notches in either direction. The cross-feed screw has a micrometer dial graduated to 0.002 in. The length of the stroke can be accurately set by a graduated scale on the column, and the ram can be positioned by a screw driven through miter gears.

The shaft bearings are provided with bronze bushings which, it is stated, can be readily removed and replaced. The driving gears are semi-steel castings and the pinions are hammered steel, both being cut from the solid. No matter what type of drive is used, the machine is provided with a friction clutch that is controlled by a lever at the rear of the machine on the operating side.



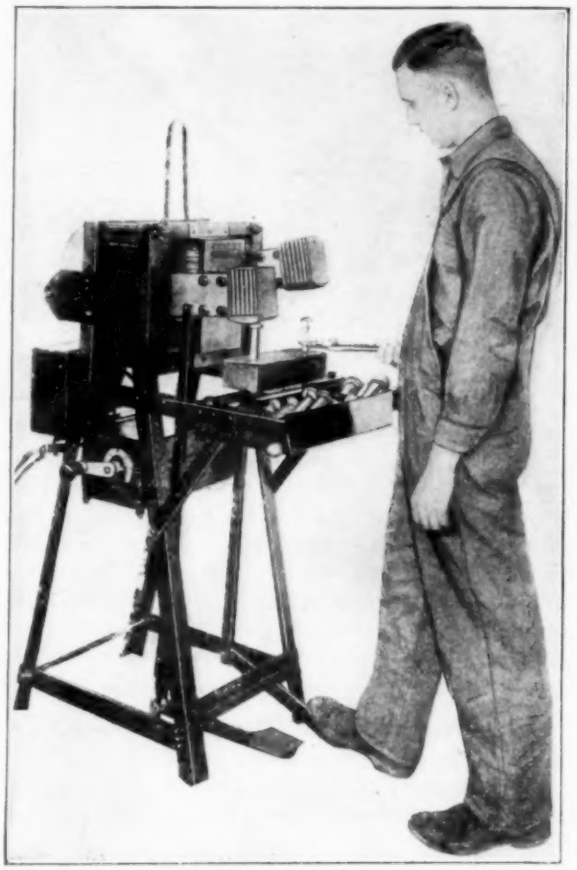
HOLLINGWORTH 28-IN. HEAVY-DUTY SHAPER

Specifications: Type of drive: cone pulley, single pulley with gear box, or direct motor. Eight changes of speed with either type of drive, using back gears. Countershaft: tight and loose pulley, 14 x 4½ in.; speed, 300 r.p.m. Floor space, 60 x 70 in. Weight: net, 5,500 lb.; domestic shipping, 5,700 lb.; foreign shipping, 6,100 lb.

G. E. Rivet-Heating Machine

The General Electric Co., Schenectady, N. Y., has recently brought out the electric rivet-heating machine illustrated herewith.

The heating unit consists of an air-cooled transformer with a single-turn short-circuited secondary, in which the rivets to be heated form a part of the secondary circuit. The primary winding is designed for 220,- 440- or 550-volt single phase circuits of 40, 50 or 60 cycles. The primary winding is connected to a drum controller, so that six different voltages can be obtained on the secondary. Adjustment of rates for heating the different sizes of rivets can be made by setting the handle on the controller.



GENERAL ELECTRIC RIVET-HEATING MACHINE

The secondary coil is divided into two upper electrodes, beneath which is an electrode of cold-rolled copper. The two rivets to be heated are placed on the lower electrode and the upper electrodes are then brought into contact with them by means of pedals. If rivets are not needed as fast as the machine will heat them, one rivet can be heated at a time and in this case a switch, connecting one side of the primary can be opened.

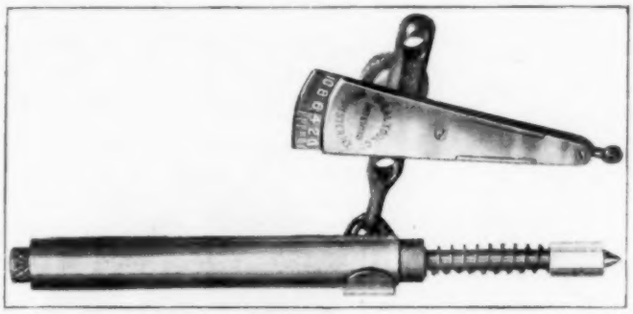
It is claimed that all adjustments can be made without danger to the operator as the control apparatus is wholly enclosed.

"Ideal" Center Tester

The illustration shows a center tester made by the Ideal Tool Co., Rochester, N. Y., and sold by Johnson & Miller, 42 Murray St., New York, N. Y. The device is used in connection with the test indicator made by the

same concern and described on page 171, Vol. 44, and on page 1144, Vol. 49, of the *American Machinist*. Its purpose is chiefly to aid in locating punch marks in line with the center of a machine spindle, either with the work stationary or revolving.

The tester consists of a holder through which passes



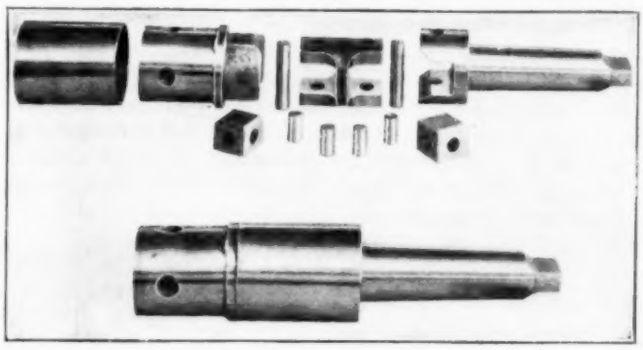
"IDEAL" CENTER TESTER

a rod carrying a center point and free to move through the holder. The holder is held in the machine spindle, and the center point is placed in the punch mark, being held there by the spring. Either the work or the spindle is then turned, the floating cone holding the center rod permitting the center point to move in case the punch mark be not directly in line with the spindle. The collar near the point thus presses on the contact point of the indicator, the deflection being shown in thousands of an inch on the scale.

The spindle and the punch mark are correctly aligned when the indicator shows the same reading entirely around the rod. The bar carrying the indicator is fastened to the holder by means of a ball joint. Thus, without using the center stem, the indicator can be swung so as to make contact with a turned surface, either internal or external, so that the device can be used for centering on drill presses, lathes and boring machines.

Cincinnati Engineering Tool Co.'s Universal Chuck

The Cincinnati Engineering Tool Co., 4659 Spring Grove Ave., Cincinnati, Ohio, makes the universal chuck that is shown in the illustration. The device can be supplied in three sizes and with any style of special shank or socket. It was developed for use with all types of boring and reaming fxtures, either of the



UNIVERSAL CHUCK OF THE CINCINNATI ENGINEERING TOOL CO.

vertical or horizontal type, that require a double support for the tool. It is said to overcome all errors due to the faulty alignment with the spindle of the machine base or table, or of the fixture.

The assembled chuck is shown in the lower portion of the illustration, and the parts of which it is composed are shown above. All parts are made of alloy steel hardened and ground to a finish. The universal joint is full-floating, and is stated to be very short, considering the movement that it allows, thereby saving considerable space and permitting its use on machines of moderate range. Tools are located in the chuck in the same manner as with a standard form of chuck. Attention is called to a safety feature of the chuck, obtained by the absence of projecting parts.

Quick Acting Fixture for Drilling and Tapping

A quick acting fixture for use primarily on drilling and tapping operations, but which can also be used on hand milling work, is illustrated herewith. The fixture

QUICK ACTING DRILLING FIXTURE

is shown mounted on a small drilling machine and the two jaws used in holding the work and the handle which operates them can be seen. The jaws are operated by a cam plate with the slot so arranged as to give a rapid motion until the jaws are almost in contact with the work, and then to increase the gripping power so as to hold the work firmly.

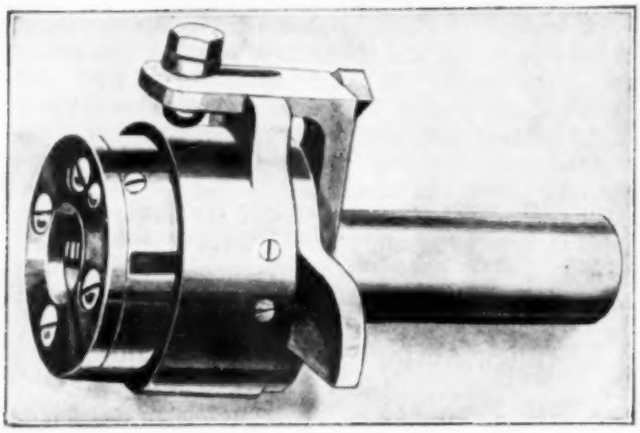
The fixture has a large hole through the center so that the work drops through as soon as the jaws are opened, and in this way saves considerable time in handling. The fixture is also provided with an arm for carrying drill bushings, that can be removed whenever found desirable. This device is manufactured by The Waldon Tool and Metal Manufacturing Co., 13 Ferry St., Norwich, Conn.

"H & G" Die Head for B & S Automatic Screw Machines

The Eastern Machine Screw Corporation, New Haven, Conn., has recently brought out the die head illustrated herewith and which is intended for use on Brown & Sharpe automatic screw machines.

The main feature of this die head is in the provision for holding it from revolving while cutting. Instead of the ordinary pins, an extension of the shell engages both sides of the overhanging arm attached to the body. The trip lever has been so designed as to make its operation sensitive enough for cutting very fine threads.

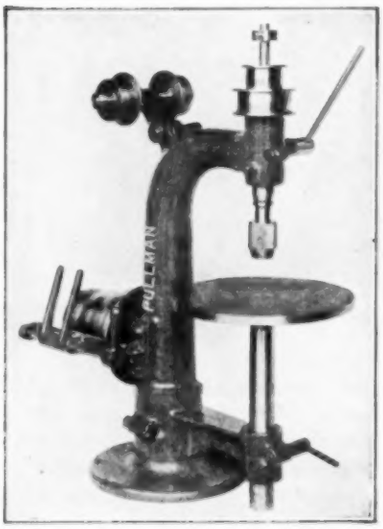
The adjustment for length of thread is made by a



"H & G" DIE HEAD FOR B & S AUTOMATIC SCREW MACHINES

screw which brings the tripping button to the proper point. It is claimed that the thread can be cut to a shoulder or a given point with great precision and that by a simple adjustment the depth of cut can be controlled to within one-half thousandth of an inch.

Pullman High-Speed Bench Drill



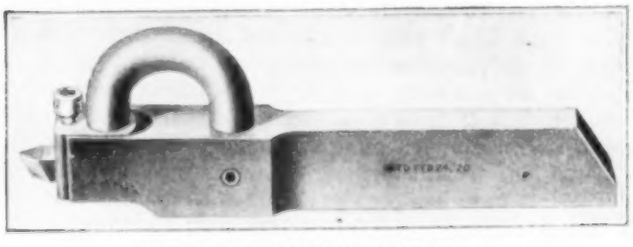
PULLMAN HIGH-SPEED BENCH DRILL

Specifications: Maximum distance from spindle to table, 9½ in. Maximum vertical movement of spindle, 3 in. Distance, center of spindle to frame, 6 in.; drill capacity, ¾ in. Height, 28 in. Weight, 85 lb. Weight crated for shipment, 90 pounds.

The bench drill shown in the illustration has recently been placed on the market by the Pullman Ventilator and Manufacturing Co., York, Pa. It is rated as having a capacity of 12 in. and takes drills from No. 0 to ¾ in. diameter, being intended for high-speed work on small parts. The machine can be furnished with a chuck, as shown in the illustration, or with the spindle-end bored for a No. 1 Morse taper. A two-step cone allows variation in the speed.

Miner Spring Toolholder

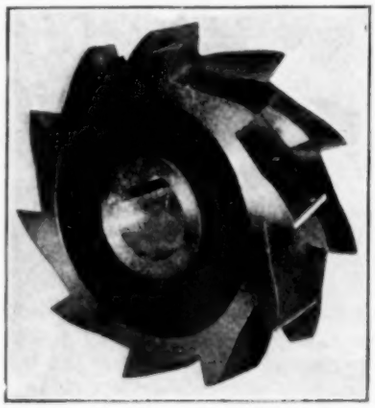
The Miner-Fuller Co., Plainfield, Conn., has placed on the market a spring toolholder, shown in the illustration. The toolholder is recessed in the front end for the section which carries the toolbit, this section being attached to a spring-neck as shown. This construction allows the tool to spring back and forth, but prevents any side motion. A full-length toolbit can be used, and the holder can be used as a solid holder if desired. The shank is heat-treated, and the spring-neck is of tempered toolsteel. The holder takes a ⅝-in. square toolbit. The shank is ⅞ x 1¼ x 7 inches.



MINER SPRING TOOLHOLDER

Bridgeport "Herringbone" Milling Cutter

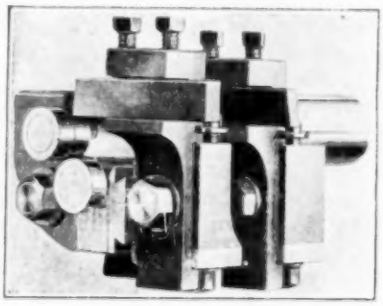
The Bridgeport Cutter Works, 50 Remer St., Bridgeport, Conn., has added the "herringbone" type, shown in the illustration, to its regular line of milling cutters. The cutter has, as its name would indicate, a double-opposed helical form of tooth, though the helices do not meet at the center as would a true herringbone. The cutters are made in two parts, permanently joined together. Cutters can be furnished in all diameters from 2½ to 8 in., and in any width from ⅞ to 1½ in. The material used is a standard brand of high-speed tool steel.



BRIDGEPORT "HERRINGBONE" MILLING CUTTER

Biggs "Tangent Cut" Box Tools

The P. H. Biggs Machine Co., Cleveland, Ohio, has placed on the market two box tools, one of which (Model C) is shown in the accompanying illustration. These tools are intended to facilitate high-speed production of screw products or other parts which are machined in turret lathes. The tools are made entirely of steel, and are hardened throughout. Shanks, rollers, and studs are ground to size. The outstanding features of these tools are said to be the angular manner of setting the tools, and the fact that they are so designed that the cutting tools may be removed, sharpened, and replaced without disturbing the original adjustments. The tools are furnished in four sizes for turning from ⅞ to 1⅝ in. All tools of a given size are made with parts interchangeable.



BIGGS "TANGENT CUT" BOX TOOLS—MODEL C

The publication of "Quarterly Statement of Imported Merchandise Entered for Consumption" has been discontinued by the Bureau of Foreign and Domestic Commerce. It is not required by law, and its publication was discontinued with the issue covering the quarters ending with March 31 and June 30, 1920.

The yearly statistics will be published in Table No. 9 of the Annual Report on the Foreign Commerce and Navigation of the United States for 1920, and that table will be also issued as a separate report.

Business Conditions in England

British Domestic Markets Show Little Sign of Relief—Automotives and Machine Tools Quiet—Unemployment Decreases Slightly—Cost of Living Coming Down

BY OUR LONDON CORRESPONDENT

FLICKERS of light have once or twice tried to show themselves but gloom has prevailed, and the notification of pending removal of the excess profits duty has been quite ineffective on enterprise. Indeed, despite protests it has always been clear that this duty, while contributary, has never been a prime cause for the decline in trade and industry. The overseas markets may be described as non-existent, and until the central and other parts of Europe are on a firm basis no revival can be expected. Great Britain depends to a large extent for her food on her ability to export, and every effort will be made in that direction; but the government credit scheme has hung fire and a fresh start is being made. Some time ago announcement was made of the conditional contract obtained by the Armstrong-Whitworth organization to repair Russian railway plant. Now it is gathered that before long the Polish authorities will be on the market for a similar purpose, but no decision has yet been reached as to whether a British firm will be asked to undertake the repair of locomotives in their own shops in Poland, or to equip and possibly run Polish government shops for the same purpose. A charter, too, has been granted by the Chinese government by which power is given for the formation of a corporation having half Chinese and half British capital, removing the restrictions by which foreigners could not hold land or property outside the treaty ports. The corporation will provide technical and financial assistance by setting up factories, etc., of all kinds, and giving opportunities for British trading in China. The difficulties that confront traders have been shown up later by the marked objection in Italy to meet bills against goods purchased from Great Britain when exchange rates were more favorable—or should it be said unfavorable—to the continental buyer.

Another attempt has been made by means of exhibitions to liven-up business. In pursuance of a set plan, and as a rival to Leipsig, the Board of Trade, in conjunction with local chambers of commerce and so on, again organized a series of three industrial fairs, in no way clashing as to exhibits, and held one each for a fortnight in London, Birmingham and Glasgow. (Next year they may possibly all be centered in London.) Many foreign potential buyers were invited and a number came. In order that they might make their progress along the length of Great Britain without undue hurry, the Glasgow fair, closing in a few days, is a week behind the others. Any engineering shown was at Castle Bromwich, the center for Birmingham. But it was mainly of the hardware variety, with a few motors and ordinary cycles, a few machine tools, some woodworking machinery and a fair amount of small tools. Oringinally, these were banned by the Machine Tool Trades Association, but at the last moment the embargo was removed. Very little that is new was shown and, in regard to business done, as a corpse-reviver the exhibition failed.

The latest available returns show 1,223,000 workpeople registered as unemployed, together with 730,000 on short time, these numbers being of course apart from unregistered people out of work, etc. One of the few grains of comfort recently had been found in the fact that the rise in the figures of unemployment, which amounted at one time to more than 65,000 a week, dropped to less than 35,000; unfortunately, the figures have lately risen again so that nearly 40,000 are being added weekly to the unemployed. To meet the dangers of young girls and lads being out of work and consequently on the streets, juvenile employment committeees are organizing instructional and recreation centers and the Labor Ministry recently ordained that attendance at approved educational, etc., courses may be made a condition for receipt of unemployment pay in such cases. The government out-of-work insurance pay is to be increased to £1 a week for men, 16s. a week for women, and so on. Besides being of service in the manner intended, this allowance occasionally operates in rather odd ways, to say the least. For instance, it is possible to find engineering workpeople who, though they could perhaps be employed four days a week, prefer to be engaged three days. The explanation is that, being employed only half a week, they thus become qualified for half the government unemployment pay. In addition, they receive a donation for the same purpose from their trade union, and thus, from the income point of view, it may well be quite as profitable to work three days as to work four.

Machine Tools Not Selling

The machine tool industry is quite flat. While Pearn-Richards universal machines have actually been advertised for, among smaller and medium-size tools the only demand of late has been for certain classes of milling and grinding machines. This notwithstanding, one of the few firms specializing in grinding machines has practically closed down for the time being. Small tools have been in fair call. Few firms, in the Midlands at any rate, are working full time, and from 16 to say 25 hours a week is to be regarded as fairly normal now. India, Australia and Japan have been described as the relatively bright spots, but the home trade is in very poor condition. It is thought, too, that conditions are further depressed by the action of the government in auctioning-off many machine tools from munition factories. The prices obtained are not good and it has been suggested that if the remaining tools, etc., were held back an enhanced price may be obtained when trade shows signs of life, the difference more than paying for the loss of interest on present-day values. It is understood that the Machine Tool Association is urging this on the government. Despite conditions, most firms remain in existence, though one, the Storey Machine Tool Co., Ltd., New Cross, London, S. E., is being sold-up. This firm had been in existence 40 years or more but was not at all well-known in the engineering world until comparatively recently, having in the past acted rather as a factory for certain merchants. Some years ago these merchants erected and equipped

their own works elsewhere, and when openly entering the field the Storey firm, despite their manufacturing experience, were handicapped by the fact that they did not know the customers to whom the tools they made had been supplied.

Automotives Quiet

The motor industry may be described as working at half time. In the words of the official announcement of the Institution of Automobile Engineers "owing to the present state of trade it has been thought wise to cancel the proposed (summer) visit to Birmingham and as an alternative a three-days meeting will be held in London." A number of cuts in prices have been announced within the last two or three weeks. For instance, the Swift Co. has taken off various sums according to the type of car, averaging say about £40, and the 2-3 ton Daimler commercial chassis has been reduced by about £250. Then £100 was taken off the Citroën car. The new range of licensing fees has kept a number of cars off the road. The tax for the pleasure car is at £1 per hp. according to the accepted rating, and the minimum is £6, the license for a Ford car costing £23, while the Rolls-Royce car costs about £49. With a view to reduction of power, and therefore presumably of tax, a London firm has introduced bushes to suit Ford cylinders, thus diminishing the bore. The estimated saving of tax, if the authorities agree, is £7 7s. Motorcycles too, which in the past could be licensed for £1, now cost 30s. to £3, and if a side-car is added this means another £1. The license is usually for a year, but it is not necessarily taken out for a full year. This has worked out rather curiously. The motorcycle industry is of course no better off than others. But, although the overseas trade has dropped badly and the home demand is poor, firms are not altogether without hope, for they argue that the motorcyclist is postponing his orders until after the first quarter, in order to avoid something like a quarter's duty on the license. As to ordinary cycles, it has been said that improvement in demand has already shown itself, but it must be remembered that many machines were held in stock from last year. Many people are inclined to hold back in view of possible reduction in prices and for this reason agents have not been willing to take risks. In order to re-assure them Rudge-Whitworth, Ltd.,—"under no apprehension of a sweeping reduction in bicycles, motor bicycles or sidecar prices"—have promised to make good any reduction in price that may be announced between a month ago and May 31 next; that is to say, they will credit or refund the difference, if any, on all machines supplied during the period specified. The dealer, of course, undertakes to refund the reduction to his customer. A move in somewhat of the same direction has also been made by the Westinghouse Morse Chain Co., Ltd., Letchworth.

Financial Returns

Returning to automobiles, the report recently issued by Crossley Motors, Ltd., showed a decline, the profits for the year ending last October amounting to £35,642, or rather less than a quarter of the profits on the preceding year: the dividend for the second half of the year was therefore passed. With good will now entered at £1, the value of the stock in hand has nearly doubled in the year, being £986,424. Leyland Motors, too, paid no dividend on the ordinary shares, although the report, which is concerned with 9 months only, shows a profit exceeding £215,000. The stock held here has more than doubled in money value. Then again, the affairs of the Austin Motor Co. have been the subject of much conversation, some of it mere chatter. Particulars have been published of a scheme to enable the company to attend to its creditors, for it is proposed to issue a million pound 10 per cent first mortgage debentures, one half of which will be offered for public subscription, being required mostly to clear commitments by way of mortgage notes and debentures. The sum of £400,000 will therefore be paid to the trustee, to acquire these notes, etc., to be merged into the pending issue of debentures. These by arrangement with suppliers of material will act as security for paying-off systematically, over a period of 18 months, amounts due. All creditors who agree must pledge themselves to take no separate action to enforce payment of their debts without the concurrence of the majority. Affairs of at least two other motor car combinations are in the balance, and in the case of one well-known engine firm unless further capital can be raised by the company or other means are available to appease creditors the latter will probably enforce winding-up; then it is estimated that, if the negotiations are carried on with care, the creditors may receive an amount not to exceed 10s. in the pound. On the other hand the directors of the Wolseley motor concern (really a branch of Vickers, Ltd.) seem satisfied and, to turn to another section of engineering, Mather & Platt, Ltd., Manchester, had in 1920 the best year of their existence, with "distinctly good" present prospects. The net profits amounted to £285,211.

The Cancellation Evil

The cancellation trouble has lately reached sections of engineering which could heretofore be regarded as in a fairly satisfactory condition. Certain of the larger electrical firms now complain and woodworking machinery manufacturers have similarly been troubled. One firm has lost the work on an order amounting to £15,000 for Brazil, while another of its customers, a home firm, simply wrote "with reference to our order for machines kindly cancel." These machines were of a somewhat special character, valued at £1,000, and were due for delivery about three weeks after the receipt of the letter. Textile machinists can still claim to have enough in hand, but orders are evidently getting worked-up, as times of delivery quoted are steadily becoming shorter.

The shipbuilding industry has notoriously been suffering, and the estimate has been made that within the last 12 months the number of vessels stopped was 70 per cent more than the number of contracts obtained in the same time. British shipping is held-up to the extent of 10 per cent, according to one estimate, and the coal crises, which is thought to be inevitable as the result of the unexpected decision of the government to end financial control on March 31, will not help matters. The commercial connection, for Great Britain at any rate, between coal and ships is obvious. Apparently the fight will turn on the question of a national as against a district or pit wage.

The Stork Helps Business

One branch of industry, not hitherto regarded as of much importance from an engineering point of view, namely, baby carriage manufacture, is said to be prosperous; for during the war period no small section of the British public remembered the biblical injunction to

increase and multiply. As a consequence one firm of motorcycle and engine makers, commonly employing about 600 men and now having about 50 working at little more than half time, have just gone into business as producers of perambulator frames, etc.

Official reports state that the value of imports by air last year reached £677,047, with exports at £339,108. Such articles as clothes and furs seem to have predominated. Those among you who, like our friend E. A. Dixie, think that air services can be carried on profitably by "war- and poverty-stricken Europe" will be a little disconcerted to note that the Handley-Page daily service—the last from this country—to the continent, London to Paris, has beeen discontinued. This resulted from the subsidy of about £600,000 granted by the French government to the French air transport companies, thus wiping out English competition. The calculation has been made that with full load of 2,000 lb. at 100 miles per hour the cost of freight by air is 6d. per lb., including all charges, using the DH-18 machine. Some scheme to insure resumption of British flight between London and Paris seems probable.

H.C.L. Going Down

Turning to the brighter side, the cost of living as officially estimated has lately shown a marked decline and with a fall of 14 points was, at the beginning of February, 151 per cent above the cost in July, 1914. Though part of the decline is doubtless due to the need of shopkeepers, etc., to realize,—retail declines are well behind wholesale—it is for the most part a permanent drop and in many instances must lead to wage reductions, although there are a number of classes who have managed to force up wages and salaries on the basis of increased living cost without any automatic fall should such costs be reduced. During January it is known that nearly 700,000 workpeople received a net increase amounting to about £54,000 weekly in wages, while about 1,450,000 sustained a net decrease amounting to about £168,000 a week. Owing to the decline in trade causing lower consumption and to the greatly reduced orders from abroad, together with, as it has happened, a lower demand from home domestic customers due to the mild weather, the output of coal miners has decreased until the whole of the increased wages that accrued since the last dispute have been removed automatically. In fact, it may be said that the tendency all around is definitely toward reductions in wage rates for workpeople. This movement certainly applies to iron and steel in its semi-manufactured state, but it has not so far reached the finished manufactured stages, that is, it does not apply to those who are classed as engineering workpeople.

Fallacy of Wage Claims

The cost-of-living figures as officially estimated have been several times mentioned in these columns, and for the purpose of argument on wage matters are often regarded as absolute. They are based on the spendings of a workman, with wife and two children, having an income before the war of 28s. a week, and the family is supposed to buy the same commodities to the same extent both pre-war and at the date of calculation for percentage. Calculations relating to about 2,000 families were made in 1904, to set the original standard. This explanation is itself sufficient to expose the fallacy of many of the wage claims that have been made and, in fact, admitted. It is expected that the new figures which will be available in about a fortnight will show a further drop of at least 5 points.

Reconstruction of the Krupp Works at Essen

By OUR BERLIN CORRESPONDENT

THE main strength of the now destroyed German war machinery rested on two groups of works solely devoted to the manufacture of war material, the one, private-owned, of Krupp and the other consisting of the State Arms and Ammunition Works, now organized as a company, The Deutsche Werke, or German Works, but still state property.

The state establishment, being by far the largest in Germany and having had no peace manufactures to fall back upon, naturally constituted the most difficult of the many problems presented by the readjustment of the enormous German war industry. There was a certain time after the armistice, when the existence of the works stood entirely in question. Labor trouble of a specially violent nature, and the process of the compulsory wholesale destruction of a large part of the machinery, made it appear very likely that the works would not survive the crisis, and be prevented from making a fresh start, an event which would have been rather welcome to the German industry as a whole.

It is now two years since the reconstruction in both works was taken in hand. While, however, the state owned works, in spite of all the financial support and influence of the government, are still in the infant stages, the Krupp works at Essen are already on a fair road to new prosperity.

This reconstruction work, performed in two years, is an achievement of no mean order, when considering the size of the plant, and the adverse circumstances existing. In comparison with the slow progress of the state works on a similar task it is held out as another instance of the advantages of private ownership, and the failure of the socialization theory.

Before the war Krupp employed 80,000 men altogether, of which 42,000 were in the service of the Essen works, 38,000 were distributed over the other works of the firm—the Gruson works, the shipyards at Kiel, and the steel works. During the war the floor space in Essen was increased from 280 to about 500 acres, and the number of workers to 115,000.

Whole Layout of Plant Changed

Of the work's original destination there is hardly any evidence left. The adaptation was carried out with much thoroughness, so that the workshops almost appear to have been designed for their present purposes. This was of course helped by the foresight of the management, in the general lay-out and equipment of the new buildings erected during the war. A peaceful vocation for the latter had been in view from the first, not because the disastrous end of the war was in any way anticipated, but because the firm could not think of

keeping all their largely extended plant employed with the manufacture of war material in peace time. The extensions therefore are not of the nature of improvisations, but have been built on a most solid scale. Few building alterations were made, the builder's share in the reconstruction having been more or less restricted to a thorough cleaning up. Nevertheless a visitor, familiar with the works during wartime, will receive from them an entirely new impression, which no doubt is caused by the radical changes in, and the re-arrangement of, equipment. Judging from appearances, this huge task was performed without stint. The firm's enormous capital reserves, accumulated during the war, were applied to the re-establishment of business on the most solid basis possible under the unstable conditions. A considerable part of the equipment consisted of machinery designed for armament purposes only. This plant has disappeared as if by magic. The firm had no option but to scrap this machinery, as under the conditions of the Peace Treaty it had to be made unsuitable for further use, which resulted in the destruction of all essential parts. The remnants were unsuitable for adaptation, and ended in smelting furnaces.

Preference for American Machinery

The present equipment consists in the main of a careful selection of the best machine tools of the former plant. This machinery has been thoroughly overhauled and appears to be in a good condition. Much of it had been sorted out, and new tools put in instead, wherever the present manufacture required them. Great care has evidently been taken to preserve machinery of American origin, of which the firm possesses quite a little. Nearly all leading American makes are still represented in the Krupp plant, foremost among them being automatics. Similar observations regarding the retaining of American machinery may be made in most German plants, an evidence of the esteem in which it is still held, in spite of the fact that no American tool in Germany has done less than seven years service. This also explains the fact that of the multitude of tools offered on the second-hand market, comparatively very few are of American make.

In pre-war times the manufacture for peace purposes in the Essen works was limited to parts of locomotives and rolling stock in general, motor parts, castings, high-grade steel and various kinds of machinery, mostly built by contract and not on a manufacturing basis. The list of new manufactures adopted is extensive and shows considerable variety. Foremost is the manufacture of locomotives on a large scale, after standardized design; motor vehicles, from motor cars down to motor rollers; tractors; harvesters and agricultural implements of all kinds; textile, oil and sugar machinery. Another department is devoted to the manufacture of small tools and gages. How diversified Krupp's interests are is shown by the fact that they have entered into a combine with the Ica Werke of Dresden, a factory for photographic and cinematograph apparatus. Not all the new manufacturing lines are already in a state of perfection; the locomotive department is farthest advanced, while others are still in the experimental stages. If the work in these departments proves as successful as the locomotive enterprise, Krupp's will soon be in the front rank of Germany's machine building industry, and no doubt will become a formidable rival to English and American firms.

Fight Against Socialism

The efficiency of the plant has greatly improved during the last year, but apart from the food condition, which is still far below the normal, it still bears witness to the fact that the Krupp works have been a hot-bed of the most advanced socialistic theories. The unrest following the revolution, made itself strongly felt in the Krupp works. The situation improved after the discharge of the large army of temporary workers, who constituted the radical element chiefly. All skilled workers were retained at full wages, during many entirely unproductive months. This enormous sacrifice of Krupp's has really saved the situation, and was to a large degree instrumental to the ultimate success of the reconstruction work.

Condition of the Railroads in Soviet Russia

FROM A CORRESPONDENT IN RIGA

THE famine in Central Russia and the sufferings of the people are due, not so much to the experimental administrative methods of the Bolshevik government, as to the bad condition of the Russian railroads. According to government statements there are in Siberia 20,000,000 poods of grain which cannot be moved on account of the lack of locomotives and cars.

Telegrams were received here yesterday (February 27) telling of revolts in Petrograd and Moscow caused by the fact that the population had received no bread for three days. We know from the Bolshevik reports that of the 7,500 carloads of grain which should have been received at Petrograd during February only 3,000 were delivered by the railroads. Only 4,000 carloads will be delivered in March.

The Soviet government, of course, is using every possible means to speed up the railroads but it is a hopeless task because the tracks are out of repair, the locomotives and cars are worn out and the railroad workers are underfed and have no ambition to work. Even the best government—providing the Soviets should be abolished—could not feed the population and establish relatively tolerable conditions in Russia unless the railroad service could be greatly improved.

Russia herself is unable to build and repair locomotives and cars. She must have foreign help and locomotives at least must be purchased from foreign markets. In 1913 there was a shortage of 2,000 freight locomotives and 80,000 cars, according to a careful estimate made by the Ministry of Communications. As to the number of new locomotives and cars added during the last six years we have no statistical data but the number is probably very small. Figures are available, however, to show the condition of the Russian locomotives in 1914. Of the 20,000 locomotives then in service on all railroads, more than 25 per cent were over twenty years old and practically worthless for efficient service.

The war laid a heavy burden on the railroads. Car loadings were increased from 750 to 1,200 poods and as a result deterioration was rapid. Maintenance of way work was entirely insufficient because of the mobilization of skilled labor and the condition of the track fell away rapidly.

Before 1914 each engineer had his own locomotive and was responsible for its condition. In that year the system was changed and the changing crew plan was adopted. Inspection was careless and as there was no one responsible for the condition of the locomotives they soon got into very bad shape. The revolution only made things worse and today the Russian people are suffering the consequences.

The Bolshevik official organ *Novy Put*, for February 26, in discussing the railroad situation says, "There is no escape, the paralysis of the railroads must come in the near future and only a miracle can save us from the approaching catastrophe." That the miracle will appear is doubtful but the catastrophe seems to have begun. The revolts in Petrograd and Moscow are significant signs.

The worst problem that faces the railroad management is the lack of fuel. The same *Novy Put* reports that in January the railroads obtained only 77.7 per cent of the necessary firewood and 48.5 per cent of the necessary coal. We hear that the shortage for February is worse.

As to the fuel used in 1914, 70 per cent of the Russian locomotives used coal, 20 per cent liquid fuel and 10 per cent firewood. When the coal and oil districts of the South were lost by the Bolsheviks there was no recourse but to change over the locomotive fireboxes to burn wood. This was no easy task but in 1919 86 per cent of the locomotives in service were wood burners. Now the problem is to supply the necessary wood for the railroads that do not touch forested areas. Instead of usable freight the railroads of the North and East are mainly occupied in transporting fire wood for those of the South and West.

The solution of the railroad problem in Russia cannot be reached without foreign help and more particularly American help. The Bolshevik government has arrived at the same conclusion but is up against the difficulty of lack of means. The available gold which, according to reliable information, is only about 350,000,000 rubles, is not sufficient to pay for all that Russia needs. There are raw materials for export but the quantities are comparatively small and their transportation to the water front is almost impossible on account of the destruction of the railroads. It is estimated that Russia has printed paper money to the extent of 1 million million rubles. This means a gold reserve ratio of something like 0.05 per cent. The paper money is obviously practically valueless.

As to the future of raw materials which form the bulk of Russian exports, it is anything but bright. All the big farms which produce for export have been destroyed and many of the small farmers have no horses, no cows, no fertilizers and no desire to work and produce for the Soviet commissars. At the present time they are producing little more than enough to supply their own needs and the populations of the cities and towns are suffering accordingly.

The Bolshevik government understands the situation and plans to spend all the available funds for railroad locomotives and equipment and for machinery for factories and agriculture.

The Importance of Justice*

By A. L. DeLeeuw

There are two lines along which human tendencies present themselves; or rather, there are two sets of qualities with which we have to reckon: the individualistic, and the social tendency. Among the first, we find the desire of the man to protect himself and his family, the desire to lead as easy and comfortable a life as possible, the desire to safeguard himself and run as few risks as need be, the desire to answer the call of the wild, drop his work and go out and commune with nature or loaf or whatever term may best fit the occasion. Most of these desires are rather an annoyance to the employer, because to gratify them means high wages, fewer working hours, many devices to safeguard the workman, and much absence from work. On the other hand, there is the desire to store up nuts for a cold winter day; in other words, to obtain a competence; there is the desire to grow—physically, mentally, morally; there is what we generally call ambition, and which is really nothing more or less than this same desire to grow; the desire to produce something. And all of these desires help the employer.

The second line of human tendency is based on the instinctive desire of human beings to herd together. It leads to the protective instinct on the part of the strong, and the wish to be protected on the part of the weak. There is, perhaps, no better demonstration of this tendency than the existence of labor unions, which means a voluntary sacrifice on the part of some for the purpose of protecting others and which is intended to be a safeguard for those who cannot help themselves. Whether labor unions always work along these lines is another question.

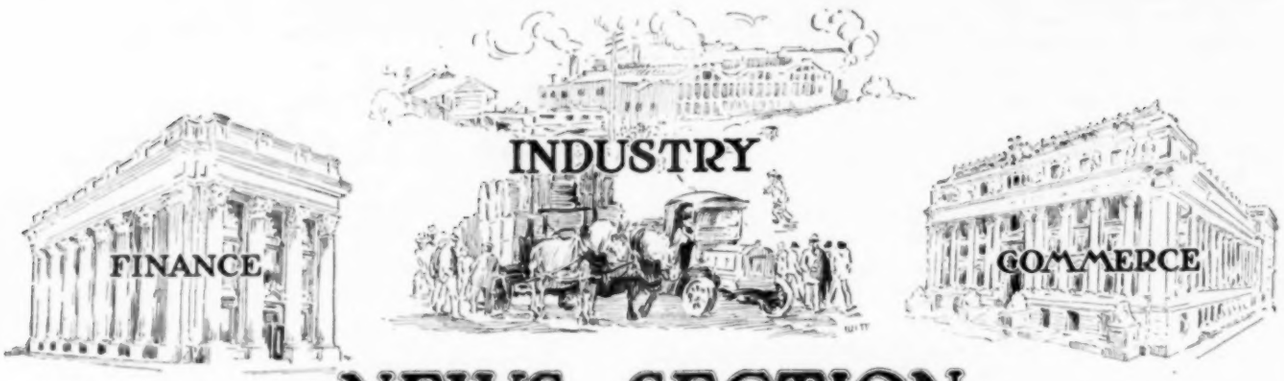
Our whole social structure is based on these tendencies, and there is one peculiar tendency which is not at all primitive and which might be said to be the line along which human beings differentiate from animals, that is, the sense of justice.

There are many other peculiarities, tendencies, desires and principles which govern the conduct of men. It is impossible to go into them within the scope of this short paper. Moreover, most of them are merely manifestations, in one form or another, of the fundamental tendencies common to all humans.

They must be kept in mind constantly. There is no way of ignoring them successfully nor of getting around them. Above all, the employer should remember that, though for a time he may ignore any or most of the natural desires of his men without a hopeless breaking-down of the existing relations, ignoring or outraging the sense of justice will have its disastrous results immediately. Men do not want charity or protection; they will suffer want in silence, if they know that nobody profits by it; but one act of injustice, though it may cause them hardly any suffering, is resented to the end.

It is chiefly for this reason that the author believes in some form of definite contract between employer and employee, such as the task-and-bonus plan or any other plan by which both the amount of product and compensation are properly fixed and their relation maintained. He further believes that no form of welfare work alone, no paternalistic control, can be successful unless this craving for justice has first been fully satisfied.

*Address delivered at the joint meeting on Industrial Relations of the Metropolitan Section of the A. S. M. E. and the New York Section of the A. I. E. E., March 25.



NEWS SECTION

Havoc Wrought by Dust Explosions

The immense damage that may be caused by dust explosions needs no more striking example for its portrayal than the wrecking of a great Chicago grain elevator that occurred on the evening of March 19. This explosion was recorded in the newspapers throughout the country, but the illustrations shown here will no doubt convey added information about this great disaster. The grain elevator is one of the largest in the country and was built a few years ago at a cost of about $10,000,000 by the Chicago & Northwestern Ry., and leased to the Armour Grain Co. The explosion fortunately occurred when only watchmen were on the premises, thus reducing the probable death list to six. About 500,000 bushels of grain was destroyed, and the building was damaged to an extent that will exceed $5,000,000.

Special Elevator Construction

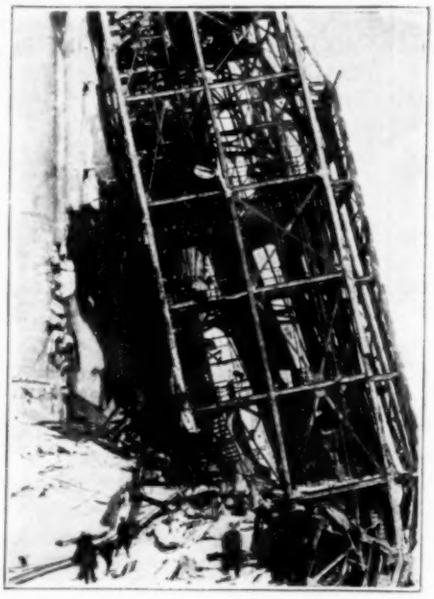
It will be noted that a large portion of the superstructure over the bins is still in place. The officials of the company ascribe the fact that there was not almost total destruction of this structure to the construction of the cupolas, drier house, conveyor galleries and marine tower. These were designed to provide relief for just such an explosion as has occurred; they had frames of heavy steel construction, but were enclosed by very light curtain walls that afforded little resistance to inside pressure, and so gave immediate relief when the explosion developed. These walls were wire mesh coated with a light covering of concrete, known as "gunite," and their value in this particular instance is shown by the completeness with which they have been blown off. Adjoining structures such as the drier house and the car shed were completely destroyed and their wreckage lies at the base of the bins.

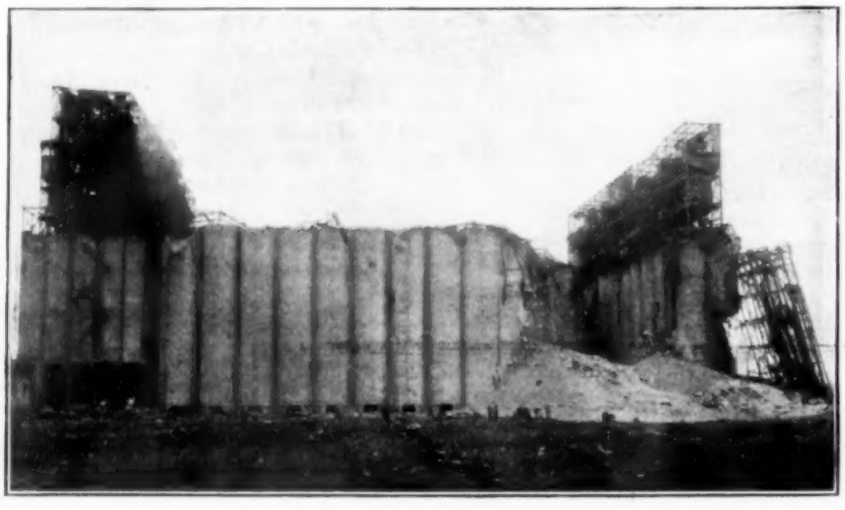
A Secondary Explosion

Reports indicate that there were two distinct explosions, the first of these occurring in the drier house. It is probable that the first explosion shook loose great clouds of dust throughout the structure and these burned, carrying the secondary explosion flame through all of the buildings. The danger of secondary explosions has been noted in many examinations of previous disasters, and has been proved by experimental tests that were made by the Bureau of Mines.

Danger Occurs in Many Factories

While most dust explosions have been noted in mills handling and storing grain and in coal mines, still the danger exists and damaging explosions have occurred in widely scattered plants. It has been demonstrated that this accident will happen in any industry where quantities of inflammable dusts are produced. Wood-working plants and factories engaged in grinding or polishing operations on materials that produce a combustible dust, are all subject to this hazard. When the dust is distributed through the air in the right proportion, only a source of ignition is required to fire what has proved to be an explosive mixture of terrific power. Various causes can start the explosion, although the reasons most commonly ascribed have been open flames, static electric sparks and broken light bulbs, and even sparks produced in grinding operations.





Belgium Decorates Two American Engineers

Decorations have been conferred upon Daniel Letham and W. C. Bull by the Belgian government for their assistance in connection with the handling of the machine tools which were purchased in this country. Mr. Letham was made a Chevalier of the Order of the Crown for his assistance in the selection of the machine tools. Mr. Bull was made an Officer of the Order of Leopold Second for his service in handling transportation matters connected with the shipment of the tools. Both these men are prominent in the machine industry.

Business Conditions as the Big Banks of the Country See Them

High Wage Rates Are Illusory and Their Reduction Must Precede a Return to Normal Business, Says National Bank of Commerce

World-wide liquidation has reached a point where it cannot be halted for the benefit of any group or unit of production either in the United States or elsewhere. Employers and workers who are unwilling to face present conditions frankly and courageously are retarding resumption of normal business and working against their own interests. Prevailing wage scales, which under present conditions are of little real advantage to the workers, are an absolute deterrent to the lowered costs which must be established before the prices of coal and steel can be lowered and freight rates altered. High wage rates are purely illusory as long as widespread unemployment or part-time work reduces real income and impairs purchasing power.

The primary and wholesale markets, which for a time showed a spotty improvement, have in many lines again become dormant. Steel output has fallen to less than one-half of mill capacity. Railway traffic and earnings are decreasing week by week, production of coal has fallen to the lowest point in four years and building operations lag far behind the total of new construction known to be in immediate demand. Slow and moderate liquidation of borrowing from the Reserve banks is reflected in the slight but steady improvement in the reserve ratio of the Federal reserve system, although the fact should not be overlooked that a substantial part of this improvement is the result of gold importations, which have continued uninterruptedly for many months. There have been further marked declines in wholesale prices, but coal and steel, while lower, are still out of line with the general price level. Buyers remain unwilling to contract for other than immediate necessities, which are at a minimum.

Money Rates Rise

The reserve ratio of the Federal reserve banks has in the period under review risen from 49.6 per cent on Feb. 11 to 50.9 per cent on March 11, but the general situation has not materially changed.

There is little basis for any expectation that borrowers in general will secure their requirements at lower rates for some time to come. Nominal market quotations, however, may give an appearance of easier money conditions.

Production Picking Up

There is a growing recognition of the necessity for lowered freight rates on heavy tonnage items which can only be effected when there have been corresponding reductions in the wage scale both of railroad employees and of labor in the basic industries. The steel industry as a whole is reported to be operating at about 40 per cent of capacity. Price reductions on the part of the independent steel makers have not resulted in large orders.

A further decline in the price of cotton has somewhat affected demand for many classes of cotton textiles, but orders for immediate requirements continue to be placed. In certain staple lines there has been marked improvement.

Ginghams have moved well following drastic price cuts made several months ago by the large producers. Cotton consumption for February was 395,563 running bales, as compared with 366,270 running bales during January. Silk and wool manufactures, which were first to feel the effects of liquidation, have shown a measurable degree of improvement. There is a distinctly better movement in tires, and automobile inquiries and sales have increased encouragingly.

Building at Standstill

Although there have been reductions in the price of many building materials, high wage rates and working rules which make economical employment of labor impossible, together with high freight rates, have prevented material lowering of construction costs. As a result building has been restricted almost entirely to absolutely necessary work. The F. W. Dodge company's review of building and construction activity during February estimates new contracts awarded in the states north of the Ohio and east of the Missouri at $100,789,000 as compared with contracts for $216,663,000 awarded in February, 1920. A considerable volume of inquiries indicates that there is a potential demand which will make itself felt as soon as and not until costs of labor and material are lowered to what the public regards as reasonable. Meanwhile, the disinclination of labor not only to accept lower wage rates but to give adequate return for wages paid will continue to restrict new housing, thus directly preventing a reduction in rent which, next to food, is the largest single item of the workingmen's living expenses.

Railway Traffic Declining

Official statements indicate that both gross receipts and net earnings of the railroads fell off sharply during the month of January, in spite of the slight improvement which took place in many lines of business following the first of the year. Estimates of railroad earnings for February and the first two weeks of March indicate a further decline in traffic. Reduction in operating expenses commensurate with reduced receipts is impossible with the wages and working conditions established during government operation and still in effect. The working conditions in force on the railroads, like those in the building trades, are a burden on the entire community. Arbitrary regulations which make it necessary to employ several skilled men for work that one man could do are in conflict with common sense.

Guaranty Trust Co. of New York Warns Against Influx of Foreign Goods—Emergency Tariff Bill to Pass at Special Session of Congress

A statement by Secretary of Commerce Hoover that definitive figures on this country's foreign trade for February would show that imports of goods already in large supply here were increasing alarmingly has been followed by the announcement that the Republican members of the House Ways and Means Committee and the Senate Finance Committee, with the approval of President Harding, have agreed upon the passage of an emergency tariff bill as the first item on the legislative program of the special session of Congress called for next month. Mr. Hoover sees indications of a centering of world shipments upon American markets because of the high prices prevailing here and the desire to obtain dollar credits. He declared that notwithstanding the large surpluses of such domestic goods as cotton, wool, food products, and other primary commodities, foreign importations of these same commodities are being received steadily. In his opinion tariff legislation is apparently the only alternative now visible to stem this flood of foreign commodities coming to compete with domestic surpluses for sale in American markets. It has been decided, therefore, to repass, without change, the tariff bill vetoed by President Wilson, except that its period of operation will be reduced from a year to six months. The program as announced also contemplates the enactment of an anti-dumping law to pre-

vent dumping of foreign goods on American markets until the tariff schedules can be increased, an amendment of the Underwood Tariff law so as to place an American valuation on imports, and immediate preparation by the Ways and Means Committee of the permanent tariff bill to be introduced in the House about three weeks after Congress convenes on April 11.

Mr. Hoover's Policy

Mr. Hoover has publicly indicated the lines along which he will proceed in his proposed reorganization of the Department of Commerce. He makes it plain that notwithstanding his ambitious program for increasing the usefulness of his department he believes this can be, must be, done without materially increasing the cost of ad ministration. Of his plans he says:

"In order to do service to the greatest advantage I wish to establish a wider and better organized co-operation with the trade and commercial associations, and will in a short time present some plans to this end. I want to see our efforts to push our foreign commerce more closely related to our industries. This sort of enlarged activity is within the original purpose of the department and requires neither legislation nor burden upon taxpayers. This is no time to ask for appropriations to undertake new work. It is the time to search for economy and reorganization, for effective expenditure on essentials, the reduction of less essentials, and elimination of duplication.

"Outside of voluntary measures, the only immediate extension of service lies in securing greater internal efficiency. The future of the department in its abilities to meet the needs of our industries and trade must await the thorough reorganization of the whole executive machinery now being vigorously undertaken by Congress.

"The great economic difficulties that we inherit from the war are obvious enough, and they emphasize the necessity of better governmental machinery to assist in their solution. Their final remedy must rest on the initiative of our own people—the rate of recovery can be expedited by greater co-operation in the community and with the community by the Government, and this department and the whole Government wishes to assist wherever it can to stimulate and assist this co-operation."

Employment Steadier

The United States Employment Serv ice, obtaining its information from 1,433 firms in 65 principal industrial centers, reports that on Feb. 28 there were 1,626,958 workers employed, as against 1,643,253 on Jan. 31, a decrease of 16,295, or 1 per cent. The returns of this organization show that the greatest unemployment during February was in the iron and steel industry, a decrease of 7.3 per cent in labor employed being reported. Railroad repair shops showed a decrease of 6.6 per cent in the number of men employed.

According to reports made to the Department of Labor for February, ten industries showed increases in the number of persons employed, as compared with January, while in four industries there were decreases. The largest increase, 42 per cent, is shown in the woolen industry. Men's ready-made clothing shows an increase of 21.1 per cent and hosiery and underwear an increase of 20.8 per cent. The smallest increases, 0.8 per cent and 0.2 per cent appear in iron and steel and leather. Percentage decreases of 12.8 per cent and 3.3 per cent appear in car building and repairing and cigar making respectively.

When comparing February, 1921, with January, 1921, eight industries show an increase in the amount of money paid to employees and six show a decrease. The most important increases, 34.6 per cent and 31.4 per cent, occur in men's ready-made clothing and woolen respectively. Car building and repairing shows a decrease of 14.4 per cent while the decrease reported in the leather industry is 0.8 per cent.

Business Conditions Firm

Business conditions are about as they have been for several weeks, with the buyers of the country still holding to their belief that a lower level of commodity prices is about to be established. Purchases accordingly continue on the basis of ordering only to meet urgent needs. The farmers are busy with their planting and are not giving much attention to the marketing of their stored crops. Their buying, as shown by the reports of the mail-order houses, is marked by extreme conservatism. The steel industry continues to reduce its output, the average being about 35 per cent of capacity for the whole country. There are some indications of greater activity in building. Railroad traffic, reported slightly better than last month, is considerably less than it was a year ago. Altogether, the situation is indicative of the waiting attitude which seems to have taker possession of the people of the country. In the best informed quarters there is confidence that the underlying strength of industry and commerce and a belief that the settlement of the major problems here and abroad will stimulate business and help to solve the many minor ones which now vex the world.

The Money Market

The feature of the money market during the last fortnight was the fact that income tax and excess profits tax payments and the general overturn of funds on March 15 had apparently not the slightest effect upon the rates for demand funds. From the seventh to the sixteenth of the month no change in the posted rate for call money on the New York Stock Exchange occurred. On the latter date the rate went down from the prevailing rate of 7 per cent to 6 per cent. Call funds were obtainable for even less on private arrangement. The time money market has been quiet, rates being quoted at 7 and 7½ per cent, and only a moderate amount of business being done.

Improvement in the position of the Federal Reserve system continues. The ratio of total reserves to net profit and Federal Reserve Note liabilities was 51 per cent at the close of business on March 18, and the volume of Federal Reserve Note circulation fell below $3,000,000,000 for the first time since February, 1920. The reserve ratio is slightly lower than it would otherwise be by reason of a change in the method of computation. Under the new method, both the "deferred availability items" and the "uncollected items," the first of which was formerly added to and the latter deducted from the regular deposit fund in computing net deposits, are omitted.

Readjustment of Wages Must Accompany the Revival of Industry—National City Bank of New York Analyzes Present Situation—Foreign Trade Reassuring

The mild winter has been followed by an early spring and with the revival of outdoor operations there are symptoms of improvement in business, although they are not sufficiently pronounced to justify sanguine predictions. Retail trade continues surprisingly good in the cities, and wholesale distribution is very fair, considering the low prices of farm products and the amount of unemployment reported. Payments through banks reporting to the Federal Reserve Board and passing through the clearing houses are running 20 to 25 per cent lower than a year ago, which is not so great a decrease as might be expected in view of the decline of prices. The index number of commodity prices compiled by the Bureau of Labor for February last was 33 per cent below that of February, 1920. Current payments, of course, do not accurately represent current business, and considering the amount of unemployment at this time, it must be concluded that they are holding up better than production.

The movement of goods in retail trade makes a better showing than any other feature of the situation, indicating reserve buying power and that commodity stocks are being reduced. There is not the amount of distress that might have been expected from so much unemployment, nor the number of business failures that might be expected following so severe a depreciation of values. The most encouraging circumstance is the fact that the readjustment of wages and prices which is necessary to a general revival of industry is steadily progressing, and without a serious amount of friction.

One of the notable incidents of the month was the agreement between the meat-packers and their employees, by which the latter accepted a moderate reduction of wages. A compromise was brought about by negotiations in Washington in which the Secretaries of Agriculture, Commerce and Labor participated. The labor leaders yielded to representation by these officials to the effect that in view of the decline in cost of living and particularly the decline in prices of the live stock which these operatives were handling, packing house wages ought to come down.

Fair play requires that the compensation of workers in all industries shall rise or fall together. Moreover, when it does, employment is not disturbed; the workers are still able to buy each other's products; but when that balance is disturbed and any class of people suffers a severe loss of income business quickly becomes bad in the other industries and many workers are thrown out of employment.

A fair readjustment of wages in the packing industry means help toward the general readjustment which must be accomplished before there will be employment for everybody again.

Wage Reductions vs. Industrial Revival

It is a not uncommon remark that employers are taking advantage of the state of depression and unemployment to force wage reductions. It is an ill-advised comment, calculated to cause bad feeling and indicates a want of understanding of the actual requirements of the situation. The fact is that depression and unemployment exist because the industrial situation is out of balance, and there is no remedy except by such readjustment of wages and prices as will restore the balance and enable the various industries to exchange products on a fair basis. It is impossible when one-half the people of the country have lost approximately one-half their purchasing power for the other half of the people to go on without taking note of it. The depreciation of money which resulted from the war was not a natural or permanent development. Nothing of the kind has ever happened without a readjustment afterward, and it is always the case that the sooner that adjustment is accomplished, so that normal relations are restored between the industries, the better for everybody.

It is of no advantage to the workers in any industry to have costs maintained upon a level which prevents the sale of their products. Somebody must have the sagacity to attempt a restoration of the conditions under which an exchange of products is possible. The compensation of workers in the various branches of industry, which means their purchasing power, must be brought back into equilibrium. Whether it will take a long time or only a short time depends upon the rapidity with which the public comprehends the situation, and remarks of the kind referred to do not promote an understanding.

The iron and steel industry is operating at about 35 or 40 per cent of capacity. Prices continue to be shaded, pig iron of some grades selling under $25. The demand for structural steel is restricted by the high cost of everything, including steel, and especially the high wages in the building trades. Railroad consumption is restricted because practically the entire income of the roads is absorbed in paying the wages of their employees and for coal. Iron and steel are still high-priced, for one reason because wages in the industry are more than 100 per cent above pre-war rates, and for another reason because railroad charges are so high. The advent of spring has given a start to the automobile industry, which has increased the demand for steel in that quarter. The demand from agricultural implement makers is light, because the farmers are not in position to buy implements on the present level of costs, and the International Harvester Co. is both laying off employees and reducing wages.

This illustrates the hardships which the process of readjustment involves when it proceeds in this halting way, with many industries and many traders holding back. It is a hardship for workmen to have their wages cut and their time cut simultaneously, but a time cut alone accomplishes nothing in reducing costs. It is a hardship for workmen to be out of work entirely, and it entails loss to the whole community. It is a hardship for workmen who have taken wage reductions to have to pay full war-time charges for having their clothes or shoes made, or for railroad or street car service. It is a hardship to have goods at retail remain high when producers' and wholesalers' prices have fallen. Everybody who is insisting upon the old wages or prices for himself while accepting cheaper service from others is delaying the revival of prosperity.

Foreign Trade Situation

The foreign trade situation has not changed for the better in the past month. In one respect the European situation may be said to be reassuring. As time passes the menace of general revolution and social disorder is less threatening. Few people now think there is any probability of the Bolsheviki overrunning Europe or that anything more socialistic than a mild type of state-ownership is possible. Hundreds of representatives of labor organizations from all the countries of Europe have been in Russia to see the workings of the Soviet system, and their reports are not favorable. Europe is getting tired of disorder and short rations, and beginning to appreciate that production must go before distribution and consumption.

The unachieved settlement with Germany is the great obstacle to recovery in Europe, Allied troops have marched into Germany, but Lloyd George admits that this gets nowhere, and that it is impracticable to occupy the country. It has been proposed that British purchasers of German goods shall be required to pay one-half the value to the British government, receiving a receipt which may be transmitted to the German creditor together with a payment of an equal amount in cash, the German creditor to present the British government receipt to his own government for reimbursement. The German government has not assented to the plan, and unless it does the prospect is for a heavy falling off of trade between the two countries. The natural result would seem to be a shift of trade, so that each country will trade more with other countries.

F. A. E. S. Opens Offices in Washington

With the opening recently of its suite of offices in the National Savings and Trust Co. Building, in Washington, the Federated American Engineering Societies will direct its work in the future from the national capital. L. W. Wallace, the executive secretary of the organization, has been in Washington completing the arrangements for the opening of the national headquarters. He will not be able, however to take up his residence in Washington for another month. In the meantime, the offices will be in charge of A. C. Oliphant, the assistant secretary.

The principal effort being made at this time at the offices of the Federated Societies is in connection with the extension of the employment service of the organization. In addition to having one central controlling office the plan is to have branch offices in several of the larger cities. A full report on the employment service is to be made when the executive board meets in Philadelphia on April 16. Secretary Hoover, of the Department of Commerce, the president of the organization, expects to attend the executive board meeting. At this meeting a comprehensive report also is to be made on the activities looking to the establishment of a Department of Public Works.

Copies of a model bill on the matter of licensing engineers now are available at the office of the executive secretary. These bills are being sent out to those interested, not with the idea of offering a recommendation one way or the other in the matter, but in the hope that any state legislation which may be enacted will follow the general lines of the model bill which is the result of extended study.

New Steel Plant in Georgia

A site comprising more than eight acres and with a 1,000-ft. frontage opposite Fort McPherson, near Atlanta, has been purchased by Austin Brothers, manufacturers of steel bridges and structural steel, and announcement is made by officials of the company that construction work will begin within the next thirty days on a new plant. No announcement has been made as to the magnitude of the plant, but it will be one of the largest structural steel plants in the Southeast.

Tentative Program for Annual Meeting of U. S. Chamber of Commerce

The general theme of the ninth annual meeting of the Chamber of Commerce of the United States, to be held at Atlantic City, April 27 to 29, will be: "In the public interest more business methods in government; less government management of business." This announcement was made by the chamber today in making public a tentative program for the convention.

All of the questions to be brought before the meeting will be approached as they relate to the general subject. Speakers will include government officials and leading business men in many lines of finance, commerce and industry.

Much of the work of the convention will be done as heretofore in group sessions. Groups representing the major divisions of business will take up, first—problems peculiar to the industries or interests within the group, and second—major problems common to all business, which will include the question of the tariff and that of taxation.

The program for the meeting marks a new departure for the chamber in that groups will discuss questions of a more general nature than those affecting solely the industries within the group. The purpose of this is to get the fullest and freest discussion on broad general problems that touch various phases of business differently. In a membership as comprehensive as that of the chamber there is always a difference of viewpoint on important questions. The group arrangement as planned gives related industries the opportunity to express their views. Afterward the chamber if it is considered necessary can take a referendum vote of its membership on the questions considered and get after proper consideration the opinion of business as a whole.

On the day before the convention opens there will be a meeting of the National Council of the chamber, made up of one representative from each of the more than 1,400 organizations included within the chamber's membership.

In the first day of group meetings the group representing Domestic Distribution will discuss current price declines and their effects; constructive means for better marketing by produce exchanges and boards of trade, and methods of merchandising which will enable the distributor better to meet conditions of financial stringency.

Treatment of wages, contract cancellations, better accounting methods and the need of national statistics on production will be taken up by the group representing Fabricated Production. The Finance Group will have before it matters connected with the government's fiscal policy, taxation, including the proposed turnover tax, reorganization of government operations and the question of the government's future policy with respect to rediscount rates.

The group on Foreign Commerce will discuss foreign trade matters, including in its program such subjects as these—the work of national foreign trade conventions, foreign trade work of national trade bodies, foreign trade work of Chambers of Commerce, foreign trade work of banks, railroads and express companies, and the operations of foreign trade clubs. The aim here is to give an opportunity for an interchange of information as to the most approved methods of extending and prosecuting foreign trade effort. In connection with this group a meeting will be held for foreign trade organization secretaries.

The Insurance Group will discuss among other things: Private initiative as against state monopoly in insurance; insurance as a credit factor and the relations between government and insurance.

Recent agitation in Congress looking to the enactment of legislation which would provide for government management of basic industries will furnish the subject for discussion in the Natural Resources Production Group, where the main subject will be the government's relation to natural resources, including lumber, coal and oil. Another subject which will be taken up by this group is that of the proper activities of trade associations.

Transportation and communication will be considered under two groups; the first having to do with shipping, and the second railroad transportation. The subjects to be taken up by the Shipping Group are the sale of government-owned ships; the continuance of the Shipping Board and its functions as an operating organization and differentials in cost of operation under various flags. The Railroad Transportation Group will go into a report by the chamber's railroad committee, the present financial situation of the railroads in relation to plans for consolidation, and the shippers' part in rate making. The Civic Development Group will discuss "The Schools and Social interest."

When the groups meet to take up the subjects of taxation and the tariff each group will consider, with relation to taxation these questions: Should there be an increase in the income tax? Should there be a sales tax? Should there be a resort to loans? With regard to tariff policies these questions will be gone into:

(1) Should the tariff not be framed with due regard to export trade sales or the protection of manufacturing in the United States? (2) Should the fact that we are now a creditor nation alter our tariff policy with respect to protection? (3) Should the United States tariff offer trading or bargaining possibilities for international commercial treaties to encourage our export trade? (4) Should the United States tariff be liberal in its provisions in view of our desire for liberality of tariff on the part of other countries?

Taxation and tariff policies will be discussed also at one of the general sessions of the meeting. Other subjects which will be gone into at the general sessions include foreign financing, the International Chamber of Commerce, education, international relations and the relations of government and business.

Annual Election of the Machinery Club of Chicago

The annual election of the Machinery Club of Chicago will be held on Tuesday, April 19, 1921, from 11 a.m. to 5 p.m. It is stated that only resident members in good standing will be eligible to vote and that the presentation of the membership card is necessary to obtain a ballot. A nominating committee under the chairmanship of Clyde W. Blakeslee has prepared a list of nominees for the board of governors. The following candidates have been nominated for the term of one year: S. A. Ellicson, O. F. Weydell, A. W. Smith and Herman F. Kempe. For the term of three years there are the following nominees: H. E. Procunier, D. R. Hoffman, H. J. Reeve and Herbert S. White.

Hoover Offers Logical Course for Resumption of Trade with Russia

The following is from a recent editorial which appeared in the New York *Commercial:*

Perhaps the cleverest statement of the case that has yet been made regarding trade relations of this country with Soviet Russia is that of Secretary of Commerce Hoover. Hitherto discussion has been largely academic and has served little purpose other than to confuse the public mind. The chief difficulty has been that those who have discussed the matter have not had that intimate personal contact with actual conditions which alone makes possible a logical, concise statement of fact. They have gleaned their information and drawn their conclusions from written reports and interviews. This does not mean that such conclusions are without value, but it does withhold from them that clarity of analysis which stamps a judgment as authoritative and inspires confidence in the public.

There have been numerous general statements as to what this country should do in the matter of specific trade relations with Russia, but Mr. Hoover comes forward and argues with his customary definiteness and directness why we should not enter into such relations. The economic system put into practice by the Bolsheviki has practically resulted in a standstill of production in Russia. Therefore, her exportable commodities are almost negligible, and as a consequence her ability to import is extremely limited. Russia's only exportable commodities worth consideration are gold, platinum and jewelry, the value of which has been variously estimated at from $60,000,000 to $200,000,000. When this has been expended nothing remains as the basis for trade. Moreover, these com-

modities in themselves can scarcely form such basis since the title of Russian gold has been called in question by the French Government, which places obvious complications in the way. Restoration of the economic stability of Europe demands that Russia resume production, but the goods which Russia would obtain in return for the value of her present exportable commodities would in no way enable her to do this.

It is right here that Mr. Hoover cuts directly to the heart of the matter, when he declares that the root of the situation is not so much economic as political, for Russia's power to produce can never be restored under the system which the Bolsheviki are attempting to enforce. Hence, it is not only essential, but inevitable, that in time, and doubtless in a short time, that system be abandoned, or if not deliberately abandoned it will fall because it is a flimsy structure built on a foundation of false theories and treacherously unsound principles. The Bolsheviki are trying to save it by propping it up with brute force, but props are only very temporary affairs at best. For a long time it has been rocking dangerously in a violent wind of popular distrust and rebellion, and if not thus blown over will presently crash to ruin through the collapse of its foundations. Mr. Hoover's argument is that it would be an ill-advised waste of time, effort and money to attempt anything in the nature of definite trade connections with Russia at present. It is not common sense to try to do normal business with a nation suffering from the severest kind of hysteria. His contention is that the only sane and logical course is to wait until that nation shows signs of a return to reason.

In view of Mr. Hoover's extensive experiences in Russia and other European countries, his advice in this matter should prompt considerable thought.

New Foundry Grows in Ashes of Old One

Just two months to a day from the time fire destroyed its plant at 15 Albany St. the R. P. Power Foundry Co. at Worcester, Mass., has reopened a bigger and better plant. Last Saturday the heat was turned on under the furnaces and operations were resumed. The work of reconstruction was done by the company itself thereby giving employment to its own men. The plant was badly damaged by one of the many fires that raged in Worcester on Jan. 19.

The plant as rebuilt is 150 x 75 ft. in dimensions and is better equipped than was the old plant to do the general foundry jobbing business which the company has done for years under the direction of Mr. Power. The plant normally employs 75 men and Mr. Power declares that when present orders are out of the way there will be new ones enough to keep the furnaces going.

Hammacher-Schlemmer Co. Not To Dissolve

In view of the many conflicting rumors going about the business world recently, concerning the supposed dissolution of Hammacher-Schlemmer & Co., that company has issued a general denial of such action.

The fact is that the company was incorporated in New Jersey in 1893, but now finds it more advantageous to change its title to the State of Delaware. Consequently the New Jersey Corporation was dissolved and immediately reorganized under the Delaware law.

There has been absolutely no change in the personnel or policy of the corporation, except the addition of several directors.

The officers of the corporation are: William F. Schlemmer, president and treasurer; August Pahl, 1st vice-president; Herman Acher, 2nd vice-president; W. H. Siebert, secretary.

The directors are William F. Schlemmer, August Pahl, Herman Acher, William H. Siebert, Walter McKibbin, Louis Schmidt and August F. Brocke.

International Acceptance Bank, Inc., Will Open Early in April

Announcement is made of the opening, early in April, of the International Acceptance Bank, Inc., at 31 Pine St., New York City. The bank will conduct financial transactions of an international nature, including the opening of dollar acceptance credits and of foreign credits on all parts of the world, negotiation and collecting of bills of exchange, and a regular business in foreign exchange, drafts and telegraphic transfers.

The officers are as follows: Paul M. Warburg, chairman of the board; Daniel C. Wing, vice-chairman; F. Abbott Goodhue, president; P. J. Vogel and E. W. Davenport, vice-presidents; Fletcher L. Gill, secretary and treasurer.

New Congress to Tackle Patent Office Bill

Probabilities favor the introduction of separate bills at the opening of the extra session of Congress to provide for Patent Office reorganization and proposing the administration of government employee patents by the Federal Trade Commission. The insistence of Senator Norris, chairman of the Committee on Patents of the Senate, on retaining the government employee patent plan as a part of the Patent Office bill resulted in the loss of both measures.

Senator Norris probably will be chosen to head the Committee on Agriculture during the next Congress. He states that he will continue to take an active interest in both these patent bills but the policy for handling them will be in the hands of the new chairman. There is a very general demand in both Houses that the government employee patent bill be considered separately and not as a rider on another bill.

Mexican Commission Touring the U. S.

A number of prominent business men and industrial leaders from Mexico, who have been touring the United States as a "Good Will" delegation for the promotion of more cordial business relations between the merchants and manufacturers of the two republics, arrived in New York Monday, March 28, where they were entertained by the Merchants' Association. A public meeting was held in the afternoon at the Hotel Astor, which was addressed by Bruno Newman, vice-president of the Confederated Chambers of Commerce of Mexico. After the address the delegates answered a large number of questions concerning financial and industrial conditions in Mexico, the conditions and efficiency of the Mexican railways, banking facilities, taxes and duties on imports, etc.

The impression gathered from the addresses and from the answers to the various questions is that Mexico is on its feet and is fast recovering from the conditions which have obtained there for several years past. The better class of Mexicans have arrived at a stage of co-operation which has put them in control of the situation, with good prospects of their remaining in control. The railways, which are under the control of the government, are making every effort to render satisfactory service, and as soon as the various States of this country have arrived at a uniform mileage rate, arrangements will be made whereby a ticket can be bought to Mexico City from any point in the United States. Car-load lots of merchandise can also be shipped through, without having to be removed from the car at the border.

Market for Electric Equipment

The statement was made that Mexico is an "electrical country," there being more electricity used in Mexico than in the United States, in proportion to the population. The country is largely mountains, with excellent facilities for water-power, and practically every town of any size is electrically lighted. All kinds of electric commodities are in demand, with the exception of the electric washing-machine. The Mexican woman, however, is an excellent laundress, and the old method of washing clothes and bleaching them in the sun is still favored.

Electric cranes are in use in a number of places such as the unloading dock at Vera Cruz and other similar places. The electric industrial truck which operates with storage batteries has not, however, made its appearance there as yet. The great extent of the mining and oil-well operations, together with the amount of electrical equipment in use, should present an opening to builders of American-made machine tools and accessory equipment. Mexican buyers, however, have to be given longer credits than is the rule in this country, the usual terms there running from six months to a year.

Importers Organize to Fight Passage of Tariff Laws

At a meeting on Thursday, March 31, at the Pennsylvania Hotel, New York, the National Council of American Importers was organized.

As this was an organization meeting no definite program of action was laid out, but it was intimated by many of the speakers that the council will "take steps to educate the Ways and Means Committee of the House of Representatives, as to the need for consideration of America's import trade." In other words a campaign will be launched to prevent, if possible, the enactment of such legislation as the Fordney Bill, which one speaker characterized as "iniquitous to the business of the United States."

Resolutions were introduced empowering the chairman to appoint an executive committee which in turn will draw up a set of by-laws and give the organization the proper means of guidance. David Walker, of Morimura Bros., New York, was chairman of the meeting.

One of the most interesting features of the meeting was the discussion as to whether foreign companies, doing business in the U. S., should be admitted to membership. The majority of those present were in favor of making this an "All-American" association, to the exclusion of foreigners. However, the matter was left to the discretion of the executive committee.

The council will meet again in April when the plans of action will probably be announced.

Obituary

John Rahn, Jr.

JOHN RAHN, JR., president and general manager of the Rahn-Larmon Co., 2941 Spring Grove Ave., Cincinnati, Ohio, died suddenly at his residence in Cincinnati on March 11. He was born in Cincinnati, Ohio, May 1, 1862, and was educated in the public schools in that city.

At an early age he placed himself under the apprenticeship of the Sebastian Lathe Co. of Cincinnati, of which Benjamin Sebastian was president. Later he became foreman and superintendent for the G. A. Gray Co. under the presidency of G. A. Gray.

In 1898 he engaged in the lathe manufacturing business for himself at 215 W. Pearl St., Cincinnati. In 1899 he was made vice-president and general manager of the company under the name of Rahn-Mayer-Carpenter Co., of which company he became president when it became the Rahn-Larmon Co., in March, 1910. He was president of this company up to the day of his death.

John Rahn was one of the few pioneers left of those connecting links of pioneer days in the machine-tool industry in Cincinnati, being a senior member of two other firms which were instrumental in putting Cincinnati where it is today in the machine-tool industry of the world.

FRANCIS U. BREWER, manager of the Machinery Club of Chicago, died at his home in Chicago on Sunday, March 20. He had been about his duties in the usual manner at the Machinery Club only the day before and his sudden death was due to an attack of acute gastritis. Mr. Brewer is given much of the credit for the increasing popularity of the club during the two years and a half that it has been under his charge. Previous to coming to this club he had been manager of the restaurant of the Fair for more than fifteen years. He had retired after this connection, but finding that he would be far happier with something to occupy his time he took up the work of the Machinery Club with marked success.

Business Items

Evidence that industry is rapidly returning to normal in the South seems indicated by the fact that the Knoxville Iron Co., of Knoxville, Tenn., one of the largest iron rolling mills in the section outside the Birmingham district, has resumed operations on a twenty-four-hour-per-day schedule, with 700 employees. Edward D. Attix, an official of the company, states that business has picked up sufficiently to insure continued operation on this schedule for an indefinite period.

At a recent meeting of the stockholders of the Atlas Wheel Co., Cleveland, O., H. P. Arnt was elected president; M. MacEverhard, vice-president, and David D. Walker, treasurer. These officers together with H. A. Duetemeyer, E. S. Reed, E. E. Ledger and E. A. Fischer, comprise the directorate. It was announced that erection of a new plant having a capacity of 3,000 wheels will be undertaken soon.

At the annual meeting of the Seamless Tube Co., of Shelby, O., the following directors were elected: A. C. Morris, R. C. Skiles, C. A. Morris, F. Wiggins, E. Mansfield, Hugh Hilderbrand of Shelby and H. H. Stoner of Cleveland.

The New Haven Millwrighting Co. of New Haven, Conn., has recently been incorporated to engage in the handling and installation of machinery, etc. The capital stock is $10,000.

The Harry E. Gilbert & Son, Inc., of Bridgeport, Conn., has recently been organized and incorporated with a capital of $100,000 to engage in machinery manufacture and general mechanical business. The incorporators of the company are: Harry E. Gilbert, Maty Gilbert and H. Lees, all of Bridgeport.

The resumption of operations at the plate mill of the Bessemer Rolling Mill, Bessemer, Ala., the latter part of February, is taken as an encouraging sign by men connected with the iron and steel industries of the Birmingham district, and the hope is expressed that the near future will witness the resumption of operations at many of the other plants in the district. The Bessemer mill had been shut down for a period of several weeks.

The directors of J. H. Williams & Co., manufacturer of drop-forgings and drop-forged tools, with works at Brooklyn, Buffalo and Chicago, and St. Catharines, Ont., Canada, have elected the following officers to serve during the coming year: President, J. Harvey Williams; vice-president and general manager, A. D. Armitage; second vice-president, Frank W. Trabold; secretary and treasurer, W. A. Watson; controller and assistant treasurer, R. S. Baldwin; assistant secretary, C. B. Harris. Mr. Armitage is also president of the Whitman & Barnes Manufacturing Co., Akron, Ohio, but will be active in the management of the business of J. H. Williams & Co.

Forthcoming Meetings

The National Metal Trades Association will hold its annual convention at the Hotel Astor, New York, on April 18, 19, 20, 21. Homer D. Sayre, Peoples Gas Building, Chicago, Ill., is secretary.

The fifth annual convention of the American Gear Manufacturers Association will be held in Cincinnati, Ohio, April 27, 28, 29 and 30.

The ninth annual meeting of the Chamber of Commerce of the United States will be held at Atlantic City, April 27 to 29, with headquarters at the Traymore Hotel.

The annual meeting of the American Welding Society will be held in the Engineering Societies Building, 29 West 39th St., New York, on April 28.

The Society of Industrial Engineers will hold its national convention in Milwaukee, Wis., on April 27, 28 and 29. Geo. C. Dent, 327 So. La Salle St., is business manager.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

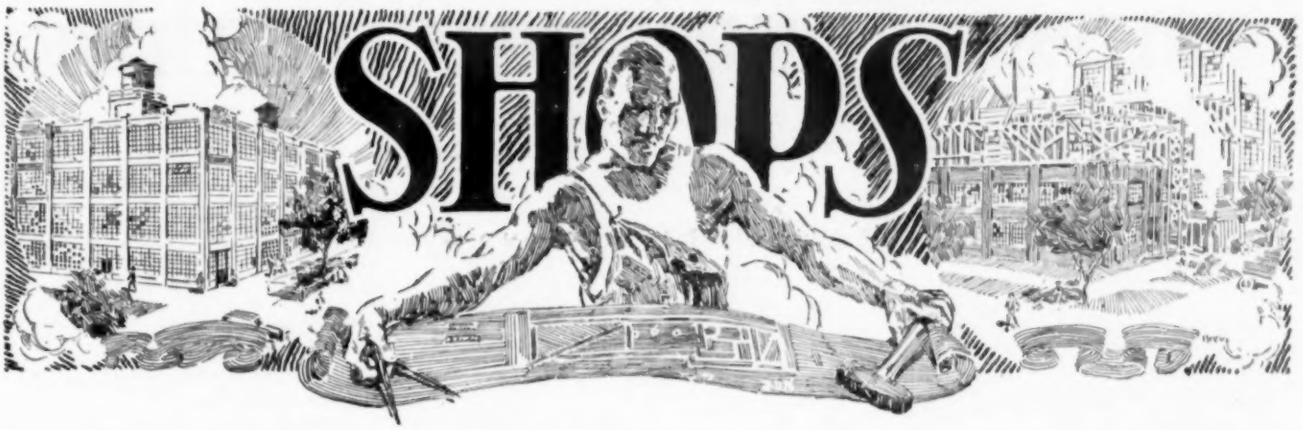
A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

Announcement is made that the regular spring meeting of the National Machine Tool Builders Association will be held in Atlantic City, N. J., on May 19 and 20. Headquarers will be at the Traymore Hotel. Ernest F. Du Brul, 817 Provident Bank Bldg., Cincinnati, Ohio, is general manager.

The spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, May 23-26. Calvin W. Rice, Engineering Societies Bldg., 29 West 39th St., New York, is secretary.

The Society of Automotive Engineers, 29 West 39th St., New York announces that its summer meeting will be held at West Baden, Ind., on May 24 to 28 inclusive.

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Mass., East Boston—(Boston P. O.)—E. F. Tanner, 63 West Eagle St.—an 18 in. Barnes lathe with all attachments for experimental work.

N. Y., Auburn—The Simplex Mfg. Co., 38-40 Market St.—one No. 18 or No. 19 Bliss flywheel press.

N. Y., Buffalo—The Contractors Ornamental Steel Co., Inc., 115 Myrtle Ave., H. W. Meyer, Purch. Agt.—threading and tapping machine for ¼ in. to 1¼ in. pipe (used).

N. Y., Lincoln Park—The Kneeland Machine Co., T. W. Kneeland, Purch. Agt.—medium size welding machine.

N. Y., Rochester—The Alent Machine Tool Co., 479 St. Paul St., N. Alent, Purch. Agt.—medium size screw machine.

N. Y., Rochester—F. S. Coolbaugh, 191 Federal St. (machinist)—hollow spindle lathe, 6 ft. bed 12 in. swing.

N. Y., Rochester—B. Goetz, 101 Central Bldg. (jeweler)—metal rolling machine.

N. Y., Rochester—C. W. Holbow, 133 Ave. C (machinist)—drill press.

N. Y., Rochester—L. Soeffling, 14 Hawkins St. (machinist)—gear cutter.

N. Y., Schenectady—The General Electric Co., River Rd.—
One cam drawing press, equivalent to Bliss No. 1-B.
One knuckle joint embossing press, equivalent to Bliss No. 22.
One punch press, 2½ in. stroke, equivalent to Stiles No. 5.
Two inclinable punch presses, 2 in. stroke, equivalent to Bliss No. 19.
Four inclinable punch presses, two of 2 in. stroke and two of 2½ in. stroke, eqivalent to Bliss No. 21.
Two 24 in. upright drills, with lever feed.
One single spindle sensitive drill, round column type, equivalent to Avey.
One speed lathe 12 in., equivalent to Blount.
One turret lathe, equivalent to Pratt & Whitney 1¼ in.
One turret lathe, equivalent to Pratt & Whitney ¾ in.
One screw machine, equivalent to Brown & Sharpe ¾ in.
One flat turret lathe, equivalent to Jones & Lamson 2 in.
One bench lathe, 7 x 32 in.
One milling machine, equivalent to Van Norman No. 2.
One vertical surface grinder, equivalent to Blanchard No. 16.
Two universal shears for profiles and bars, equivalent to Niagara.
One power hack saw.
Three shapers, one 30 in. and two 20 in.
Two wet tool grinders, 18 in. wheels.
Two tilting tumbling barrels, equivalent to 28 in. Henderson.
One four spindle sensitive drill, 15 in. overhang.

N. Y., Summitville—S. Brier (machinist) brazing machine.

N. C., Ashville—J. A. Campbell—two precision machine drills.

N. C., Burlington—The Midway Fdry. & Machine Shop, J. G. King, Mgr.—garage and machine shop equipment, including tools, etc.

N. C., Pineville—C. S. Oakley—sander, moulder, fast feed planer, rip saw, cut-off saw, band saw, shaper, tenner, mortiser and other wood-working machinery.

Va., Danville—Johnson Mfg. Co., J. A. Johnson, Purch. Agt.—small tapping machines.

Va., Doswell—Priddy & White, V. Priddy, Purch. Agt., tools for auto repair shop.

Va. Wytheville—R. P. Johnson, manufacturer of machinery, O. M. Johnson, Purch. Agt.—4 side planer and matcher.

Mich., Detroit—F. Montefore, 3513 3d St.—equipment for sales and service station.

Mich., Detroit—L. E. Murphy, Statler Hotel—millers, shapers, boring mills and complete metal working equipment for machine shops.

Mich., Lansing—The Michigan Screw Co., 506 South Hosmer St.—miscellaneous machine equipment, etc.

Mich., Ypsilanti—The U. S. Steel Co.—electric butt welder (used in good condition preferred).

O., Columbus—E. H. Huffman & Sons, 114 East Town St.—1 lathe, 2 drill presses, 1 grinder and other machine shop equipment.

O., Columbus—The Johnson Garage & Machine Co., Wall and Hickory Sts., E. C. Johnson, Purch. Agt.—complete automobile repair machinery, including lathe, drill press, and grinders.

Wis., Milwaukee—The Amer. Bander Co., c/o T. M. Lederer, 396 Lafayette Pl.—special machinery for manufacturing machines for banding cigars.

Wis., Milwaukee—G. T. Moore, 26 34th St. (machinist)—one 4 ft. lathe with approximately 6 in. swing.

Wis., Milwaukee—The Nordstrom Vulcanizer Co., 2706 St. Paul Ave., C. Nordstrom, Purch. Agt.—grinders and drill presses.

Wis., Oconomowoc—The Jenkins Barnhart Motor Co.—drill press and lathe for repair work.

Wis., Okauchee—W. Schradenbach, Main St.—power machinery and machine tools for garage.

Wis., Wauwatosa — The Hardt Garage Co., 47th and State Sts., A. Hardt, Purch. Agt.—drill press and lathe of sizes adaptable for garage repair shop.

Kan., Mulberry — The Midwest Fdry., Machinery & Boiler Co., A. W. Cunningham, Purch. Agt.—complete equipment for machine shop and foundry.

Mo., Carthage—F. W. Steadley, 930 Oak St.—machine shop equipment.

Mo., Joplin—The Union Iron Wks., 623 Kentucky Ave., W. Buttrum, Mgr.—2,000 or 2,500 lb. hammer.

Mo., St. Louis—Curtis & Co. Mfg. Co., Hamburger and Kienlen Sts., manufacturers of machinery and steel castings—Universal type piston machines.

Mo., St. Louis—The McQuay Norris Mfg. Co., Cooper and Elizabeth Sts., manufacturer of packing rings—piston machines, universal type.

Tex., Harrisburg—B. H. Elliott, Inc. (marine repair shop), W. P. Bulkley, Purch. Agt.—
One 12 in. lathe, 6 ft. bed.
One 36 in. lathe, 30 ft. bed.
One power hack saw.
One combination punch and shear.
One shaper.
One radial drill.

Ont., Galt—The Hi-Speed Tools, Ltd., H. Champ, Genl. Mgr.—equipment, iron working machinery and complete new machinery for the manufacture of screw cutting tools, gages, dies, etc.

Machinery Wanted

Conn., Stamford—Cohn & Abrams, 545 Main St.—candy manufacturing equipment.

Me., Portland—J. H. Feeney, 30 State St.—laundry equipment, 4 pocket washing machines, extractors 26 to 30 in., etc.

Mass., Medford—The Toppan Boat Co., A. Piggott, Purch. Agt.—small single surface panel planer with countershaft.

Mass., Quincy Adams—(Boston P. O.)—L. Grossman & Sons, J. B. Grossman, Purch. Agt.—two electric driven coal loaders, also other equipment for handling coal.

Vt., Burlington—The Bd. of Trustees of the University of Vermont—equipment for proposed dairy.

N. Y., Buffalo—The Hutchins Marine Laundry, 93 Elk St., H. J. Hutchins, Purch. Agt.—$10,000 worth of laundry machinery.

N. Y., Lewiston—The Riverside Pulp & Paper Co., W. Burke, Purch. Agt.—paper mill machinery.

N. Y., Rochester—C. C. Peck, 721 E & B Bldg. (mechanical engr.)—magnetic clutch.

Ala., Rockford—E. E. Brown—air drills, air pumps and gas engine for mica mining.

Fla., Palmetto—The Palmetto Crate Co., C. E. Gibbens, Secy.—complete woodworking machinery for the manufacture of orange crates and vegetable containers.

Ga., Macon—The Macon Box Co., B. B. Taylor, Mgr.—single head corrugated fastener driving machine.

S. C., Florence—Giles Bay Lumber Co., W. Barth, Purch. Agt.—locomotive crane, 10-ton capacity or larger, for standard gage track.

Va., Staunton—The Farmers Marl Lime Co., W. J. Chapman, Secy. and Treas.—complete equipment for grinding and drying marl, to have 200-ton daily capacity.

Ill., Chicago—The Mickelberry Food Products Co., 641 West 47th St.—meat packing and canning machinery.

O., Canton—The Continental Clay Co., Zinninger Bldg.—complete machinery for sewer pipe plant.

O., Cincinnati—The Pub. Wks. Constr. Co., 57 Wiggins Blk., N. Brehm, Purch. Agt.—revolving crane for unloading cars, ¾ cu.yd. bucket (Byers or Pawling & Harnischfeger or equal).

THE WEEKLY PRICE GUIDE

THIS WEEK'S MARKET

The only change in the iron and steel market is in New York, where bars, structurals, plates, hoop steel and sheets have been reduced in price, owing to the dull market. Structural shapes and steel bars are down 25c. per 100 lb. In Cleveland, steel prices are unchanged, but business is only fair. Sheets and plates find a ready market with the smaller sheet metal workers, but carload orders are scarce.

It is felt in New York that the metal market is at the long-awaited turn for the better. Shutting down the mines has toned up copper, although 13c. is still the figure for lots up to a carload. Lead, also, is stronger. The trust has raised its price twice in four days: On March 28, from 4c. to 4.1c., and on March 31, from 4.1c. to 4.25c. There is a strong plumbers' demand for lead. Manufactured brass and copper products are unchanged in the warehouses of New York, Cleveland and Chicago. Cleveland reports babbitt metal firmer following the slight improvement in the automobile industry. The old metals market is dead.

Coke reflects the stagnation of the pig iron market, and prices have fallen off 25 to 50c. per ton. Linseed oil is down 1c. in Chicago, to 80c. per gal. in 5-bbl. lots.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$30 50
Northern Basic	27 52
Southern Ohio No. 2	30 50
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	36 51
BIRMINGHAM	
No. 2 Foundry	26 50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75 sil	27 00
Virginia No. 2	*28 00
Basic	†26 25
Grey Forge	*27 00
CHICAGO	
No. 2 Foundry local	26 00
No. 2 Foundry, Southern, sil 2.25@2.75	33 00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	26 96
Basic	26 86
Bessemer	27 00

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Warehouse Jersey City	New York Delivered	Cleveland	Chicago
Structural shapes	$3 23	$3 33	$3 58	$3 58
Soft steel bars	3 13	3 23	3 34	3 48
Soft steel bar shapes	3 13	3 23	3 48	3 48
Soft steel bands	4 18	4 28	6 25	
Tank plates	3 23	3 33	3 78	3 78

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh	$2 25@$2 35
Warehouse, New York, delivered	3 13
Warehouse, Cleveland	3 52
Warehouse, Chicago	4 12

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3 20@3 55	4 23	4 00	4 68
No. 12	3 25@3 60	4 28	4 05	4 73
No. 14	3 30@3 65	4 33	4 10	4 78
No. 16	3 40@3 75	4 43	4 20	4 88
Black				
Nos. 17 and 21	3 75@4 15	4 80	4 70	5 55
Nos. 22 and 24	3 85@4 20	4 85	4 85	5 60
No. 25 and 26	3 90@4 25	4 90	4 90	5 65
No. 28	4 00@4 35	5 00	5 00	5 75
Galvanized				
No. 10 and 11	4 25@4 70	4 43	5 00	6 10
No. 12 to 14	4 35@4 80	4 53	5 10	6 20
Nos. 17 and 21	4 65@5 15	4 83	5 40	6 50
Nos. 22 and 24	4 80@5 25	4 98	5 55	6 65
No. 26	4 95@5 40	5 13	5 70	6 80
No. 28	5 25@5 70	5 38	6 00	7 10

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$5 50	$5 25	$4 84
Flats, squares and hexagons, per 100 lb	6 00	5 75	5 34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	50%
Cleveland	50%
Chicago	50%

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and hot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	42
Hot rolled copper nickel rods (base)	52
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 3/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel (heavy)	6 00	8 00	9 00
Spring steel (light)	8 00	7 00	12 00
Coppered Bessemer rods	8 50	8 00	7 00
Hoop steel	4 43	4 04	4 18
Cold rolled strip steel	9 00	8 25	9 25
Floor plates	5 75	4 00	6 03

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
⅛ to 3	57½%	44%	⅛	15½–16½%	+10½–11½%
			¼	19½–20½%	1½– 2½%
			⅜ to 1¼	24½–25½%	8½– 9½%

LAP WELD

2	50½%	38%	2	20½–21%	6½– 7%
2½ to 6	53½%	41%	2½ to 6	22½–23%	–10%
7 to 12	50½%	37%	7 to 12	19½–20%	5½– 7%
13 to 14	41%				
15	38½%				

BUTT WELD, EXTRA STRONG PLAIN ENDS

⅛ to 1¼	55½%	43%	⅛ to 1¼	24½–25½%	9½–10½%
2 to 3	56½%	44%			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	48½%	37%	2	21½–22½%	8½– 9%
2½ to 4	51½%	40%	2½ to 4	23½–24%	11½–12%
4½ to 6	50½%	39%	4½ to 6	22½–23%	10½–11%
7 to 8	46½%	33%	7 to 8	14½–15%	2½– 3%
9 to 12	41½%	28%	9 to 12	9½–10%	+2 –2½%

Warehouse discounts as follows:

	—New York— Black	Galv.	—Cleveland— Black	Galv.	—Chicago— Black	Galv.
⅛ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, Banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13 00
Tin in 5-ton lots	29 00
Lead	4 50
Zinc	5 30
ST. LOUIS	
Lead	4 10
Zinc	5 30

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20 25	21 50	23 50
Copper wire (carload lots)	15 00	17 50	20 00
Brass sheets	17 25	24 00	24 50
Brass pipe	21 00	22 00	20 75
Solder (half and half) (case lots)	19 00	20 50	17 50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	15 25
Cleveland	19 00
Chicago	18 75

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill + less 8% for carload lots..... 11.50

	Warehouse	
	In Casks	Broken Lots
New York	12.00	12.50
Cleveland	13.70	14.30
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	6.00
Chicago	6.25
Cleveland	7.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	10.00	10.00
Copper, heavy, and wire	9.00	9.50	9.00
Copper, light, and bottoms	8.00	9.00	8.00
Lead, heavy	3.25	4.00	3.50
Lead, tea	2.00	3.00	3.00
Brass, heavy	6.00	7.00	9.00
Brass, light	4.50	5.00	5.00
No. 1 yellow brass turnings	5.00	5.50	5.50
Zinc	3.00	3.00	3.10

ALUMINUM—The following prices are spot from warehouse, cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	28.1@28.2	24.50	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	22.00
Chicago	20.50
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	46.00	35.00
Commercial	30.00	16.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	List	$1.00	+1.15
Hot pressed hexagon	List	1.00	+1.15
Cold punches hexagon	List	1.00	+1.15
Cold punched square	List	1.00	+1.15

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current
New York	60%
Chicago	70%
Cleveland	70%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in.	45%	60%	50%
1¼ and 1½ in. by 3 in. up to 12 in.	25%	50%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $3.50 Chicago..... $2.50
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $4.50 Cleveland..... $4.00 Chicago..... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅜ by 6 in. and smaller	40%	50%	40%
Larger and longer up to 1 in. by 30 in.	40%	40%	40%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40%	10%
Chicago	net	net
New York	40%	25%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	45%	50%	45%
Tinned	45%	50%	30%

Structural, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York..$5.08 Cleveland..$5.00 Chicago..$5.08 Pittsburgh..$3.90
Boiler, same sizes:
New York..$5.30 Cleveland..$5.10 Chicago..$5.18 Pittsburgh..$4.00

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	22.25	25.00	25.50
Brass	21.00	24.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅛-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$8.50 per 100 lb.; New York price is 8c.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	10.00@13.00	13.00	14.25
Colored mixed	7.00@11.50	10.00	12.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13¼	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl.)	1.85
Cleveland	3.25
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$4.00@$4.50
Prompt foundry	5.25@6.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$0.80
Cleveland	100-lb. bag	1.05

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.73	$0.90	$0.80
5-gal. cans	76*	1.15	1.05

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	13.00	14.50	13.00
25 and 50-lb. kegs	13.25	14.75	13.00
12½-lb. keg	13.50	15.00	13.50
5-lb. cans	16.00	17.50	16.00
1-lb. cans	18.00	19.50	18.00

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount.

Wis., Milwaukee—The Petersen Flusher Co., 276 1st Ave., G. Petersen, Purch. Agt.—special machinery to manufacture sink drains, toilet drains, etc.

Wis., Sheboygan Falls—The Falls Roller Mills Co., c/o E. Gonzenbach, Pres.—grinding machinery.

Wis., Wauwatosa—A. Knauber, 63d St. and Johnson Ave.—one 22 in. to 26 in. band saw for woodworking plant.

Wyo., Shoshone—The United States Reclamation Service, Denver, Col., will receive bids until April 27 for furnishing one 30 ton traveling crane for the power house here.

Ont., Ottawa—The Slinn Bread Co.—special baking machinery and equipment.

Que., St. Victor—E. Villanuve—saw mill machinery.

Metal Working

NEW ENGLAND STATES

Conn., Hartford—M. L. Schoolnick, 93 Atwood St., will build a 1 story, 50 x 136 ft. garage on Flower St. Estimated cost, $28,000.

Conn., Norwalk—J. Donaldson, c/o H. W. Mather, Archt., Haviland Bldg., has had plans prepared for the construction of a 1 story, 50 x 135 ft. service station on West Ave. Estimated cost, $25,000.

Mass., Allston (Boston P. O.)— The Arcand Spring Co., 20 Cambria St., Boston, will soon award the contract for the construction of a 1 story blacksmith shop on Mechanic St. Estimated cost, $25,000.

Mass., Indian Orchard—The Chapman Valve Mfg. Co., Pine St., will soon award the contract for the construction of a 1 story, 50 x 275 ft. foundry with two 20 x 80 ft. ells. Associated Architectural and Eng. Co., 145 State St., Springfield, Archts. and Engrs.

Mass., Medford—L. B. Jeffreys, 15 Alfred Terrace, will build a 1 story, 60 x 115 ft. garage on Parkdale St. Estimated cost, $25,000.

Mass., Pittsfield—McCormick & Joyce, 444 North St., have awarded the contract for the construction of a 1 story, 45 x 80 ft. sales and service station on Maplewood Ave.

Mass., Roxbury (Boston P. O.)—T. H. Connolly, 110 Bower St., will build a 1 story, 120 x 145 ft. garage on Washington St. Estimated cost, $75,000. Noted Feb. 24.

Mass., Taunton—The Presbrey Stove Lining Co., 212 Somerset Ave., plans to rebuild its plant which was recently destroyed by fire. Estimated cost, $75,000.

R. I., Providence—W. A. Mulry Co., 97 Empire St., is having plans prepared for the construction of a 1 story, 120 x 135 ft. garage, sales and service station, on Elmwood Ave. and Russell St. Estimated cost, $75,000. B. S. D. Martin, 86 Weybosset St., Archt.

MIDDLE ATLANTIC STATES

N. J., Trenton—The Amer. Steel & Wire Co., Hamilton Ave., will build a 1 story, 60 x 313 ft. wire plant on South Broad St. Estimated cost, $20,000.

N. Y., New York (Borough of Bronx)—The Calabro Bldg. Co., Inc., 825 Burke Ave., will build a 1 story, 90 x 120 ft. garage on Hoffman St. near 184 St. Estimated cost, $45,000.

N. Y., New York (Borough of Bronx)—J. T. Tully, c/o C. Kreymberg, Archt. and Engr., 2534 Marion Ave., will build a 1 story, 65 x 100 ft. garage on 145th St. near Willis Ave. Estimated cost, $45,000.

N. Y., New York (Borough of Manhattan)—The Horizon Corp., 19 West 134th St., is having plans prepared for the construction of a 4 story, 75 x 100 ft. garage at 50-54 West 144th St. Estimated cost, $70,000. A Brociner, 110 West 40th St., Archt. and Engr.

N. Y., New York—(Borough of Manhattan) H. I. Stitler, Inc., 529 Washington St., is having plans prepared for the construction of a 2 story, 82 x 100 ft. garage, on Washington and Bethume Sts. Estimated cost, $50,000. Rouse & Goldstone, 512 5th Ave., archts. and engrs.

Pa., Pittsburgh—J. and J. B. Milholland Co., Tumell and Watson Sts., will soon award the contract for the construction of a 1 story, 56 x 123 ft. addition to its machine shop. Estimated cost, $50,000. Private plans.

Pa., Pittsburgh—M. Walker, c/o W. A. Thomas, Archt., Magee Bldg., will soon receive bids for the construction of a 2 story, 40 x 100 ft. garage on Kilpatrick and Ridgeway Aves. Estimated cost, $35,000.

SOUTHERN STATES

N. C., Raleigh — The State Highway Comn. has awarded the contract for the construction of 50 x 450 ft., 50 x 350 ft., 50 x 200 ft., and 50 x 150 ft. truck sheds and machine shops Estimated cost, $60,000. Noted Nov. 25.

MIDDLE WEST STATES

Ill., Chicago—The Chicago Blow Pipe Co., 216 North Sacramento Ave., has awarded the contract for the construction of a 1 story, 74 x 75 ft. factory, on West Lake and Clarkson Sts. Estimated cost, $30,000.

Ill., Chicago—The Runzel Lenz Electric Mfg. Co., 1751 North Western Ave., has awarded the contract for the construction of a 2 story, 50 x 60 ft. addition to its factory at 1755 North Western Ave. Estimated cost, $20,000.

Ill., East St. Louis—The Dependable Truck and Tractor Co., 231 Collinsville Ave., has had preliminary plans prepared for the construction of a 1 story, 100 x 250 ft. truck plant and power house in Washington Park. Estimated cost, $250,000. Reister & Rubach, Murphy Bldg., Archts. Noted Jan. 27.

Ind., Evansville—The Hercules Gas Engine Co. plans to build a 1 story, 250 x 250 ft. engine works. Estimated cost, $50,000. Private plans.

Ind., Indianapolis—C. and A. Potts Co., 816 West Washington Ave., will soon award the contract for the construction of a 1 story, 60 x 132 ft. foundry. Estimated cost, $45,000. Noted Feb. 10.

Ind., Muncie—The Muncie Gear Co. plans to build a 1 story, 100 x 200 ft. gear factory on North Vine St. Estimated cost, $50,000. Private plans.

Mich., Detroit—F. Montefore, 3513 3d St., has awarded the contract for the construction of a 2 story, 50 x 160 ft. sales and service station on High St.

O., Cleveland—The Jeavens Spring Co., 1603 Prospect Ave., is having plans prepared for the construction of a 5 story, 55 x 300 ft. factory and office building. Haven & Crosby, 40 Court St., Boston, Mass., Archts. and Engrs.

O., Columbus—The S. B. Hartman Estate will soon receive bids for the construction of a 2 story, 115 x 140 ft. garage, sales room and repair shop, on South 3d St. Estimated cost, $125,000.

Wis., Fairchild—The Fairchild Motor Co. has purchased a site on Main St. and plans to build a 2 story, 60 x 110 ft. garage. Estimated cost, $75,000. A. B. Ross, Mgr.

Wis., Manitowoc—N. C. Dicke Motor Co. Franklin and 11th Sts., will soon award the contract for the construction of a 2 story, 60 x 120 ft. garage, machine and show room building. Estimated cost, $75,000. Juul & Smith, Imig Bldg., Sheboygan, archts.

Wis., Okauchee — W. Schradenbach has had plans prepared for the construction of a 2 story, 50 x 80 ft. garage, etc., on Main St. Estimated cost, $75,000. A. Kuenzi, Watertown, archt.

STATES WEST OF THE MISSISSIPPI

Mo., Carthage—F. W. Steadley, 930 Oak St., has awarded the contract for the construction of a 1 story, 40 x 45 ft. addition to his chain and battery factory on Grant and 5th Sts., and for a 1 story, 50 x 100 ft. machine shop on Grant and 6th Sts. Estimated cost $5,000 and $10,000 respectively.

Mo., St. Louis—A. T. Morey, 5565 Bartmer Ave., has awarded the contract for the construction of a 1 story, 100 x 140 ft. garage with a 50 x 80 ft. wing, on Delmar and Lake Aves. Estimated cost, $75,000.

WESTERN STATES

Cal., San Diego—The Bureau of Yards & Docks, Navy Dept., Wash., D. C., has awarded the contract for the construction of a lean-to addition to structural shop, here.

CANADA

Ont., Galt—The Hi Speed Tools Ltd. has acquired an old factory and plans to remodel same and install machinery. Estimated cost $100,000. H. Champ, Genl. Mgr.

Ont., Toronto — The British Canadian Machine and Tool Co., 183 St. George St., is receiving bids for the construction of a 2 story, 40 x 100 ft. tool factory on King St. Estimated cost, $50,000.

General Manufacturing

NEW ENGLAND STATES

Conn., New Britain—The Niedzwiecki Bakery, 215 Farmington Ave., will soon receive bids for the construction of a 2 story, 45 x 65 ft. bakery. H. A. Ludorf, Mutual Bldg., Archt. Noted March 24.

Conn., Stamford—Cohn & Abrams, 545 Main St., will soon award the contract for the construction of a 3 story, 40 x 85 ft. candy manufacturing plant, on Beckley Ave. W. R. Steinmetz, 442 Atlantic St., Archt.

Mass., Newburyport—The Hannah Shoe Co. will alter its shoe factory on Pleasant St. Estimated cost, $100,000.

MIDDLE ATLANTIC STATES

N. Y., Mt. Vernon—The General Optical Co. will soon receive bids for the construction of a 1 story, 30 x 200 ft. addition to factory at 256 Washington St. Estimated cost, $75,000. Woodwell & Resler, 501 5th Ave., New York City, Archts. and Engrs.

Pa., Great Bend—The N. H. Park Leather Co. will soon award the contract for the construction of a 3 story, 75 x 200 ft. tannery. Estimated cost, $150,000. Lockwood Green, 101 Park Ave., New York City, Archts. and Engrs. Noted Nov. 18.

Pa., Pittsburgh—The Crane Co., South Michigan Ave., Chicago, Ill., will receive bids April 10 for the construction of a 6 story, 75 x 192 ft. and three 1 story, 65 x 288 ft. buildings on 24th St., here. Cost to exceed $1,000,000. Hunting Davis Co., Century Bldg., Archts. Noted Feb. 17.

MIDDLE WEST STATES

Ill., East St. Louis—Morris & Co., 1221 West Adams St., Chicago., plans to build a 2 story slaughter house. Estimated cost, $150,000. E. Schaefer, mgr. B. Stevens, c/o owner, archt.

Ind., Muncie—The Ball Bros. Glass Mfg. Co., East 9th St., plans to build a glass factory on 9th St. Estimated cost, $50,000. Private plans.

O., Dayton — The Rinderknecht Lumber Co., Huffman Ave., has awarded the contract for the construction of a 2 story, 40 x 200 ft. warehouse and mill. Estimated cost, $45,000.

Wis., Beaver Dam—The Bell Mfg. Co., c/o C. S. Knapp, 200 Burnett St., is having plans prepared for the construction of a 2 story, 45 x 90 ft. factory for the manufacture of novelties, etc. Estimated cost, $35,000.

Wis., Sheboygan—The Press Publishing Co., c/o C. Broughtoman, 725 Center Ave., will build a 2 story, 60 x 125 ft. publishing plant. Estimated cost, $75,000.

STATES WEST OF THE MISSISSIPPI

Mo., Medill—The Producers Cold Storage Co. is having plans prepared for the construction of a 3 story, 63 x 108 ft. packing plant. Estimated cost, $50,000.

Tex., San Antonio — The Gebhardt Chili Powder Co. has awarded the contract for the construction of a 2 story, 42 x 135 ft. canning plant, to include a refrigerator system. Estimated cost, $39,770.

CANADA

Que., St. Anne de Belleville—The Industrial and Educational Publishing Co. will soon award the contract for the construction of a paper mill, to include a 70 x 250 ft. machine room, 4 story, 12 x 60 ft. finishing department and 2 other buildings. Estimated cost, $150,000.